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BRIEFLY TOLD.

DEATH OF MR. CHARLES A. BENNETT, JR.—With extreme regret we report the death of Mr. Charles A. Bennett, Jr., General Manager of the Freehold (N. J.) Gas Light Company, who passed away on the afternoon of July 24th, at his residence in Freehold. The cause of his death was pneumonia. The funeral services were celebrated at Freehold, on the afternoon of the 27th inst. Next week we will print some account of his life.

A CONGRATULATION AND AN ACKNOWLEDGMENT THEREOF.—At the last meeting of the Western Gas Association the paper by Mr. S. M. Highlands, of Clinton, Ia., on the subject of "Incandescent Gas Lighting," as will be remembered, provoked quite an animated discussion, not the least incentive to which was the written belief of Mr. Highlands that the Welsbach lamp should not be too greatly encouraged by gas manufacturers, because, to quote his own words: "Were this burner to be generally introduced at once to the present line of gas customers, it would, without doubt, curtail our output for lighting purposes by at least 50 per cent., and the consequences of this wholesale reduction of the volume of our business you can picture to yourselves." The participators in the debate that followed the reading of the paper did not encourage Mr. Highlands with their support of his views; quite to the contrary, before the discussion closed, on motion of Mr. J. B. Howard, the Secretary was instructed to convey to the inventor of the Welsbach lamp (Dr. Carl Auer von Welsbach, of Vienna, Austria) the congratulations of the Association upon the merit of his discovery. In due time Secretary Dunbar carried out the instructions of the Association, and the details of the matter are contained in the appended correspondence:

OFFICE OF WESTERN GAS ASSOCIATION,
NEW ALBANY, IND., June 24th, 1895.

Dr. Carl Auer von Welsbach, Vienna, Austria—Dear Sir: The Western Gas Association, at the annual meeting, held in Pittsburgh, Pa., May 15, 16 and 17, 1895, instructed me, as Secretary, to convey to you our high appreciation of your ingenuity and skill displayed in inventing a burner which is one of the best attachments gas companies have been enabled in many years to introduce and use.

I am happy to inform you that in the United States of America the Welsbach burner is displacing the electric light, and gas companies, thanks to your invention, are regaining the patronage in lighting public and private places they had lost.

In conclusion, permit me to express the hope that you may long live to witness still greater triumphs and to reap the benefits of what you have already achieved.

With great esteem, I remain,

Yours very truly, JAMES W. DUNBAR, Secretary.
In behalf of the Western Gas Association.

[*Dr. Auer's Acknowledgment.*]

VIENNA, AUSTRIA, July 8, 1895.

To the Secretary of the Western Gas Association, New Albany, Ind.:

Herr Dr. Auer von Welsbach orders me to acknowledge your amiable

letter of the 24th ult., and to thank you for the therein enpressed honorable recognition of his invention of the gas incandescent light.

Very respectfully, FELIX KUSCHENITZ.

THE STATE OF TRADE.—On July 1st we mailed 60 circulars to as many gas companies at well-situated points in the States and Canada for the purpose of determining in our usual way the actual standing of the gas industry, in so far as that might be made known through comparing the sendout for the first six months of 1895 with the sendout for the corresponding period of 1894. The answers received to date (Thursday, July 25) number 42, and the total output of the reporting places is something short of 1,200,000,000 for the first half of '95. Comparing this output with that for the first half of '94, the gain in percentage for the current year is 11.21. Several of the test points report that they have not only reached but have surpassed the maximum output figures in their history. The recognition given to the value of the Welsbach lamp is also marked, one small Company asserting that it has displaced 480 incandescent electric lamps of 16-candle power each within the half year, which means very much indeed to that Company. An especially novel feature of this case is that the Company gained two consumers, in the shape of two houses built in the town since 1890, and in which gas had never been burned, and both of which had to be piped for a gas supply. The statistics respecting the increased use of gas for fuel purposes are decidedly uneven; that is, there does not seem to be any uniformity in them. Some of the towns in the middle-West report decided gains, while others report that the fuel trade is slow. One company, which charges a uniform rate for gas for all purposes, but which made, in January last, a reduction of 25 cents per 1,000 in the selling price, reports a gain for the six months in output of 21 per cent. Take it all in all, the general tenor of the replies is more satisfactory than any received since the first half of '93. Another prominent feature of the replies is the assertion: "We have made," or "We are making" notable additions to the distributing mains.

BOOKS RECEIVED.—We are in receipt of a copy of the second volume of "Chemical Technology, or Chemistry in Its Applications to Arts and Manufactures," which volume was edited by Mr. Charles Edward Groves, F.R.S., and Mr. William Thorp, B. Sc. The first volume of this series was "Fuel and Its Applications," and the second volume treats of "Lighting," but only in so far as "Fats and Oils," the "Stearine Industry," Candle Manufacture," "The Petroleum Industry and Lamps," and "Miners' Safety Lamps" are concerned. It is true that many of these things are of importance to the gas manufacturer, wherefore the book may be of value to him; but we imagine the gas men will have more of interest to them in the promised third volume of the series, which is almost ready, the title thereto being "Gas Lighting, Electric Lighting, Lighthouse Illuminations and Photometry;" and amongst those who are to contribute to its pages are Mr. Charles Hunt, Dr. Garnett, Sir Boverton Redwood and Mr. W. J. Dibdin. Coming back, however, to volume No. 2, we can truthfully say that it has between its pages a plethora of valuable matter, particularly so the article on "The Petroleum Industry and Lamps," which is by no less an authority than Sir Boverton Redwood. The publishers (Messrs. P. Blakiston, Son & Co., of Philadelphia) have, as is usual with them, spared neither labor nor art in the printing of the work, which is profusely illustrated. Another welcome addition to our library is a copy of the eleventh volume of the "Transactions of the American Institute of Electrical Engineers," which contains a well-edited arrangement of the proceedings of the Institute for 1894. Although we cannot be said to have much in common with the men electrical, that lack of fraternity is not sufficient to hold us from making the statement that the volume before us is well worth reading. A feature of it is its perfect "Catalogue of Members" of the Institute. Typographically, the book is unimpeachable, and it was prepared under the direction of the officers of the Institute, although it also may be fair to add that to our view the "fine stenographic pen" of Mr. Richard W. Ryan seems to have had "a bit of a point" in its pages.

NOTES.—At the shareholders' meeting of the Greenfield (Mass.) Gas Light Company the officers chosen were: Directors, Franklin R. Allen, William N. Washburn, William A. Forbes, Frank A. Pond and J. D. Safford; President, F. R. Allen; Clerk and Treasurer, Dana Malone. Dividends of 3 per cent. on the preferred and of 2 per cent. on the common stock were declared.——The Oroville (Cal.) Gas Company has acquired by purchase what has been known as the Porter electric light system of Oroville, and the new owner will make important changes on the plant, which, if the plain truth be told, needed bettering sadly. ——Mr. Thomas Barrett, of this city, but who formerly resided in Memphis, Tenn., is reported to have purchased the half-interest in the New Memphis Gas Light Company, of Memphis, Tenn., heretofore owned by Capt. S. S. Brown, of Pittsburgh, Pa. This seems to us to foreshadow the consolidation of the two Memphis Gas Companies.——The Kalamazoo (Mich.) electric light plant has been sold under foreclosure.

Notes on Cyanogen in the Manufacture of Illuminating Gas.

By M. G. PERTHUIS.

[In our issue for July 15th we printed an abstract of the paper on "The Production of Cyanides," read by M. G. Perthuis, before the 1895 meeting of the French Association of Gas Engineers. Since then the full text of the paper has come to hand, and in view of its completeness we have had it translated by Mr. Herman Poole for the instruction of our readers.—EDS.]

The question of cyanides in gas manufacture has become very interesting since, under certain conditions, we may make the refuse matters sufficiently rich in cyanides to be able to sell them at a more remunerative price than formerly, when they were a nuisance. We have thought it useful, then, to search among the published works on cyanogen—those having a direct application to gas making—and we give, besides, the results of several personal researches. In the course of these notes we will, we believe, point out for the first time a reaction which may play an important part in purification.

Formation of Cyanides.—It is interesting to study, first, where and under what form cyanogen is evolved in the course of manufacture. In the laboratory we find the following takes place:

Formation of Ammonium Cyanide.—If through a red hot porcelain tube we pass a current of NH_3 slowly over carbon, ammonium cyanide is produced:

$$C + 2NH_3 = CNNH_4 + H_2 \quad \text{(Kuhlman)}.$$

Take the same tube, but fill it with fragments of porcelain, heat to a reddish-white heat and pass currents of carbonic oxide and ammonia. Then, according to the relative proportions of the gases, we will have:

$$CO + NH_3 = CNH + H_2O, \text{ or}$$
$$CO + 2NH_3 = CNNH_4 + H_2O.$$

Formation of Ammonium Sulphocyanide.—In the preceding experiments replace the carbonic oxide by vapor of carbon disulphide, and we will have ammonium sulphocyanide:

$$CS_2 + 2NH_3 = CNNH_4S + H_2S.$$

From these reactions we will notice:

1. That the fixation of nitrogen is greater the higher the temperature and the slower the flow of the gas.

2. That the transformations are never complete.

In the retort the same reactions occur. Carbon, carbonic oxide, carbon disulphide and ammonia are formed under conditions of high temperature, but as the ammonia is in excess there is no production of hydrocyanic acid, but of ammonium cyanide. It being admitted that all coal contains iron in the form of sulphide (pyrites) we might expect that there would be a formation of ferrocyanide in the retort. But we can easily see that this is impossible, since all the ferrocyanides are decomposed at a heat much lower than that reached in the retorts.

ANALYSIS OF THE GAS AS IT LEAVES THE RETORT.

1. *There is no Ferrocyanide in the Gas.*—Cause the gas to bubble through an acid solution of ferric chloride; no blue precipitate forms.

2. *The Cyanogen is in the form of Cyanide.*—Cause the gas to pass over a mixture of potassa and iron sulphate, heat slightly, and acidulate with chlorhydric acid; a blue precipitate forms. These reactions distinguish the cyanides from the ferrocyanide.

3. *Sulphocyanides are present.*—The gas passing through a solution of ferric chloride gives it a characteristic blood-red color, which is destoyed by nitric acid, but not by chlorhydric.

Quantitative Analysis of Ammonium Cyanide.—The method employed for the quantitative analysis is the same as that used to separate the hydrocyanic acid from ammonium cyanide. The other methods (silver nitrate or iodine solutions, etc.) do not give a satisfactory result, because of the presence of tar and sulphuric acid in the unpurified gas.

The determination is made in the following manner: A sample of gas is taken from the pipe corresponding to the retort which is being tested. Attached to it are three flasks, followed by a meter. It is advisable to keep up a pressure of 11-tenths to 15-tenths inches during the progress of the test, so that the tubes in the flasks may have sufficient depth of liquid to give perfect absorption. The three flasks contain a mixture of potash and iron sulphate. No change should occur in the liquid of the third flask.

The reaction completed, heat gently, and add chlorhydric acid. A precipitate of impure Prussian blue forms. The impurities are tar and iron sulphide. Collect the precipitate on a filter, re-dissolve in potash, and precipitate again with the perchloride. Repeat several times till

the potash solution is clear yellow. The potassium ferrocyanide is then determined by any of the usual methods, and from it the amount of hydrocyanic acid is deduced:

No. of Test.	Duration of Heat, Hours.	Mean Daily Production per ton, Cubic Feet.	Cubic Ft. of Gas passed through Meter.	HCN Collected.	HCN per 1,000 feet of Gas.
1	6	10,595	184.7	186.134 grs.	1,007.76 grs.
2	6	10,772	149.0	159.700 "	1,071.84 "
3	12	10,666	176.8	207.248 "	1,172.22 "
4	12	10,842	169.5	202.494 "	1,200.55 "

The second table shows that the maximum production of cyanogen occurs during the last portion of the heat:

Number of Test.	Duration of Heat. Hours.	Mean Production per Day. Cubic Feet.	Cubic Feet of Gas through Meter.	HCN Collected.	HCN per 1,000 Cubic Feet of Gas.
1	1 and 2	—	166.7	Traces	Traces
2	3 and 4	108.78	138.2	46.691 grs.	337.85 grs.
3	5 and 6	—	171.5	103.466 grs.	603.13 grs.
					940.98 grs.

These experiments prove conclusively what we said in the commencement, that the production of cyanogen is nullified at the beginning of the heat as much by the copious evolution of gas as by the reduction in temperature of the carbon.

Quantitative Analysis of Ammonium Sulphocyanide.—The same apparatus, with the three flasks and the three tubes before mentioned, is used. The flasks contain a dilute solution of potash. On passing a certain quantity of gas through the solution potassium sulphocyanide is formed. None should be formed in the third flask.

At the termination of the test, add chlorhydric acid to the liquid till faintly acid. Then add a solution of copper sulphate and pass a current of sulphurous acid gas through it; copper sulphocyanide will precipitate. Collect the sulphocyanide formed and wash with faintly acid water. From this the sulphocyanide collected can be determined.

Number of Test.	Duration of Heat. Hours.	Mean Production per Day. Cubic Feet.	Cubic Feet of Gas passed through Meter.	HCN Collected.	HCN per 1,000 Cubic Feet of Gas.
1	6	10,807	137.5	29.48 grs.	214.4 grs.
2	6	10,666	145.2	33.49 grs.	230.6 grs.

Distribution and Transformation of the Cyanogen during the Process of Manufacture.

Hydraulic Main, Condensers, Scrubbers.—We have seen that all the cyanogen compounds are formed in the retort and pass through the various apparatus before being fixed in the purifiers. It seems strange that the ammonium cyanide and sulphocyanide, both very soluble in water, do not dissolve in larger quantities. This is explained by admitting that the carbonic acid contained in the gas decomposes them, setting free cyanhydric and sulphocyanhydric acids.

Purifiers.—The reactions which take place in the purifiers are numerous. They occur between the ammonium cyanide, ammonium sulphocyanide, sulphydric acid, ammonia, sulphur and the iron compounds. We were obliged to work synthetically in order to account for the manner in which the cyanogen is retained by the iron.

The material with which we experimented was disposed in a thin layer on the shelf of a small purifier about 4 inches square. This purifier had two tubes at the bottom and one at the top, through which passed the gas after absorption.

The Iron Oxide Material.—This was prepared as follows: Ferrous oxide was precipitated from a solution of copperas by potash. This oxide, collected on a filter and copiously washed, was exposed to the air till all green coloration had disappeared—*i. e.*, all the ferrous oxide had become red-brown ferric oxide ($Fe_2O_3H_2O$). This oxide, still pasty, was mixed with dry sawdust, which, inert from a chemical point of view, serves well as a separating material.

The Iron Sulphide.—In the tests we made this was obtained by exposing the oxide on the purifier shelf and conducting through it by the tube a current of sulphureted hydrogen. We thus obtained the sulphide (Fe_2S_3) of the same composition as that we find in the regular process of manufacture.

1. *Fixation of the Cyanide on the Iron Oxide.*—This experiment was arranged thus: Two balloons were prepared, one containing hydrocyanic acid, produced by the decomposition of potassium ferrocyanide by sulphuric acid; the other containing ammonia, produced by the decomposition of ammonium chloride by lime.

The two currents of gas passed into a flask with three tubes and united at the ordinary temperature, forming ammonium cyanide. This flask also serves to condense part of the moisture contained in the gases. The remainder is collected in a tube containing calcium chloride.

On the shelf of the little purifier has been placed a layer of the purifying material described above. Through this a slow current of gas was passed for six hours. At the end of this time, on lifting the purifying material, it was noticed that the layer nearest the shelf had become gray, the tint not being uniform—some parts gray, some almost black. The material was exposed to the air, the grayish portions becoming blue, the others remaining blackish. On washing the material on the filter with a weak solution of potash, we found present all the reactions for ferrocyanides.

The reactions in the test, as we believe, are as follows: The iron oxide, in presence of hydrocyanic acid, begins to form ferrous cyanide.

$$(a)\ FeO + (NH_4)_2CN = Fe2CN + (NH_4)_2O.$$

Ferrous cyanide appears grayish blue; in the air it changes very rapidly to Prussian blue, according to the following formula:

$$9Fe(CN)_2 + 8O = Fe_2O_3 + \underbrace{Fe_7(CN)_{18}}_{\text{Prussian blue.}}$$

If the ferrous cyanide is in presence of an excess of ammonium cyanide, this changes it to ammonium ferrocyanide:

$$Fe(CN)_2 + 4NH_4CN = Fe(CN)_6(NH_4)_4.$$

We can easily satisfy ourselves, after having exposed the material to the air, that it surely contains Prussian blue (which may prevent the oxidation of the $Fe(CN)_2$ and ammonium ferrocyanide. This can be done by washing it, the wash water giving all the reactions for ferrocyanides, and as the only base which enters into the tests is ammonia, the Prussian blue is found, accompanied by ammonia ferrocyanide. The material remaining after the washing with water, and which is blue, is then washed with a dilute solution of potash, which then presents all the characters of potassium ferrocyanide, which is due to the Prussian blue.

Fixation of Cyanogen. Iron Sulphide.—We commence, as explained above, by passing a current of H_2S to transform the oxide into sulphide. We then quickly change the H_2S apparatus for one generating hydrogen. This gas is inert in the way we use it, and its object is solely to expel the remaining H_2S which may be confined in the pores of the material. The current is stopped when the escaping gas no longer darkens lead acetate paper.

The apparatus is then arranged as in the test with iron oxide. ***But from the instant we begin to pass the ammonium cyanide we perceive that the lead salt is blackened anew, and continues to blacken during the whole time the cyanide is passed.***

At the end of six hours we remove the cover and notice that, scattered in the black material there are whitish-gray spots.

Exposing it to the air, the iron sulphide regenerates; the black portions become red and those which were whitish change to blue. We recognize in this test as in the preceding one the presence of ammonium ferrocyanide and Prussian blue.

The combination of iron sulphide with ammonium cyanide may be represented thus:

$$(a^1)\ FeS + 2NH_4CN = Fe(CN)_2 + (NH_4)_2S.$$

If the ammonium cyanide is in excess:

$$Fe(CN)_2 + 4NH_4CN = Fe(CN)_6(NH_4)_4.$$

The reaction (a^1), perfectly analogous to the reaction (a) above, shows and explains the evolution of a gas $(NH_4)_2S$ which blackens the lead acetate.

An evolution of ammonium sulphydrate occurs simultaneously with the absorption of hydrocyanic acid.

This experiment is confirmed in the following way, which we have had occasion to use many times in practice: Take three purifiers which the gas traverses in series. The gas from the second one will not turn lead acetate paper, but if the purifier has not been revivified for a long time and contains material carrying much iron sulphide, the gas, on leaving the third one, will blacken the paper. This is because all the ammonium cyanide has not been absorbed in the first and second boxes. This shows that ***the gas in its passage through a purifier rich in iron sulphide may become charged with sulphureted compounds.***

Notes.

First.—That we have seen in all cases the Prussian blue is not formed directly in the purifier, but by oxidation of the ferrous cyanide.

$$9Fe(CN)_2 + 8O = Fe_2O_3 + Fe_7(CN)_{18}.$$

Second.—That the sponge retains a portion of the cyanogen in the form of ammonium ferrocyanide; but as this latter substance is soluble in water, the practice followed by several works, of washing the spent oxide before sending it out for sale is not to be recommended. Ammonium ferrocyanide mixed with ammoniacal liquor will certainly give

up its ammonia in the subsequent treatment, but, nevertheless, the operation is not advantageous, since the ammonium ferrocyanide is worth much more than ammonia.

Below is the result of the analyses of some spent oxide:

No. of Material.	Per Cent. of Available Ferrocyanide.	Per Cent. of Available Ferrocyanides. (Soluble.)	Proportion of Soluble to Total. Per Cent.
1	15.5	8.7	56.1
2	16.8	4.1	24.4
3	15.1	5.2	34.4

Third.—It happens often in a purifier that instead of having a blue sponge, we take out after a while a grayish mass, which rapidly changes to blue in the air. This comes from the decomposition of the Prussian blue by the sulphydric acid into iron cyanide and ferrocyanic acid, both substances light colored, and which oxidize immediately on exposure, forming, again, Prussian blue.

$$Fe_7(CN)_{18} + 2H_2S = 6Fe(CN)_2 + Fe(CN)_4H_4 + S;$$
$$9Fe(CN)_2 + O_3 = Fe_2O_3 + Fe_7(CN)_{18};$$
$$7Fe(CN)_4H_4 + O_3 = 24HCN + 2H_2O + Fe_7(CN)_{18}.$$

Sulphocyanides.—We have seen that ammonium sulphocyanide occurs in the purifier. A portion is combined with the iron oxide as ammonium sulphocyanide,* the other portion is stopped by the moisture and is not changed. Besides the sulphocyanides, others are formed in the purifier from the cyanides present. Let us study these sulphocyanides. In the laboratory we prepare ammonium sulphocyanide by two processes:

1. Take a solution of ammonia saturated with sulphureted hydrogen, and mix it with flowers of sulphur and hydrocyanic acid. Digest in a water bath (this precaution is absolutely necessary to finish the reaction, although it commences in the cold), and ammonium sulphocyanide is formed and can be collected by filtration and crystallization.

2. Mix a solution of ammonium sulphydrate with a solution of hydrocyanic acid and crystallize.

In the purifiers we find exactly the conditions of the two preceding methods—presence of sulphur very finely divided, which may in old sponge reach as high as 45 to 50 per cent., presence of ammonia, and presence of sulphureted hydrogen.

Ammonia acting only on cyanides and Prussian blue is not detrimental, since by every contact with the blue it may form ammonium ferrocyanide.

Sulphydric acid gives, with the blue, ferrous cyanide; it is then the mixture of ammonia and sulphydric acid which must be prevented in the purifier if we would limit the production of sulphocyanides. We must then try some way to stop the ammonia as completely as possible before its arrival at the purifier; that is, we must wash as completely as possible.

Revivification.—During the revivification the transformation of cyanide into sulphocyanide is shown from the action of the ammonia and sulphureted hydrogen absorbed by the moisture of the mass, and which are always accompanied by a disengagement of heat, more so, in fact, than that due to the revivification. Again, sulphocyanide is formed when we heat ferrocyanide with sulphur or an alkaline polysulphide.

These reactions occur in revivification in the purifiers, where, if it is possible to prevent the occurrence of polysulphides, still it is impossible to avoid the sulphur.

Dr. Burschelt, in a very interesting paper (*Journal für Gasbeleuchtung*, January, 1893) showed this action of heat by numerous and exact experiments. He showed that when we take no precautions to prevent heating in revivification, it is possible to have as much as 30 per cent. of the ferrocyanide changed to sulphocyanide in one operation. He recommends by all means possible the prevention of increase in temperature in revivification in the air or in the purifier.

Analysis of the Gas at the Inlet and Outlet of the Purifier.—Below are the results of two analyses made for cyanides and one for sulphocyanides at the inlet and outlet of the purifier:

First experiment—	Cubic Feet Operated on.	Hydrocyanic Acid Collected per 1,000 Ft.
At the inlet	408.96	973 grains.
At the outlet	60.39	omitted.
Retained in the purifier		omitted.

Second experiment—	Cubic Feet Operated on.	Hydrocyanic Acid Collected per 1,000 Ft.
At the inlet	143.74	942.44 grains.
At the outlet	192.48	192.06 "
Retained in purifier		750.38 grains.

*Evidently an error.—H. P.

Sulpho-cyanhydric acid—

	Cubic Feet Operated on.	Acid Collected per 1,000 Cu. Ft.
At the inlet	161.75	141.31
At the outlet	155.04	25.81
Retained in purifier		115.50

Besides, we have determined the mean quantity of hydrocyanic acid retained in the purifiers, and this in making analysis of all the spent oxide sold during the year.

Addenda.

Some Hints Regarding the Treatment of Spent Oxide at the Works.—On account of the almost general application of the McArthur-Forrest process for gold extraction, the spent oxide is very much in demand by chemical works, but on oxide containing but a small quantity of cyanides (rarely more than equal to 15 per cent. of potassium ferrocyanide) the freight charges are considerable. A method has been sought by gas works, therefore, to remove a part of this inert matter; that is to say, to make a concentration of the cyanides. To this end two methods are employed, which we will describe:

Theory of Procedure.—The commencement of the two methods is the same. The material is mixed with lime. The cyanides become calcium ferrocyanides, the sulphocyanides become calcium sulphocyanides, the sulphur of the iron sulphide is oxidized by the lime, then leach the oxide. The calcium ferrocyanides and sulphocyanides which are soluble dissolve.

The principal reactions between the lime and the cyanides are the following:

$$\underbrace{Fe_7(CN)_{18}}_{\text{Prussian blue}} + 6CaO = \underbrace{3Fe(CN)_4Ca_2}_{\text{Calcium ferrocy.}} + 2Fe_2O_3$$

$$\underbrace{Fe(CN)_4(NH_4)_4}_{\text{Amm. ferrocy.}} + 2CaO = Fe(CN)_4Ca_2 + 4NH_3 + 2H_2O$$

$$\underbrace{2(NH_4, CNS)}_{\text{Amm. sulphocy.}} + CaO = (CNS)_2Ca + H_2O + 2NH_3;$$

and between the lime and the iron sulphide:

$$Fe_2S_3 + 3CaO = Fe_2SO_3 + \underbrace{3CaS}_{\text{Calcium sulphide.}}$$

By the first method of procedure the waters of lixiviation are concentrated. The calcium sulphocyanide is decomposed by the heat,

$$(CNS)_2Ca + 5H_2O = 2CO_2 + \underbrace{2CNH_4, HS}_{\text{Amm. sulphydrate.}} + CaO$$

At the same time different secondary products having a disagreeable odor are disengaged.

Finally we get a concentrate containing part of the calcium ferrocyanide in crystals and part in the state of impure lumps.

By the second process we treat the solution obtained with ferrous chloride, ferrous cyanide being precipitated.

$$Fe(CN)_4Ca_2 + 2FeCl_2 = 3Fe(CN)_2 + 2CaCl_2.$$

The solution contains the calcium chloride and sulphocyanide. The iron cyanide is separated by decanting, exposed to the air, and thus transformed into Prussian blue. This blue is very impure, ranging from 35 to 50 per cent.

Details of the First Method.—The oxide is first broken up, care being taken to break fine all the lumps; then mix with 10 to 12 per cent. of well slaked lime. If the oxide contains less than 10 per cent. of water, sprinkle lightly. Mix well and spread in thin layers with furrows, so as to give as much surface as possible for cooling, thus lessening the heat and reducing to a minimum the change from cyanide to sulphocyanide.

During these manipulations the sponge changes color and becomes yellow from the formation of calcium sulphocyanide, and above all from the oxidation of the iron.

Lixiviation.—We have tried to keep account of the rapidity of lixiviation and the necessary quantity of water. We placed in a tank 220 pounds of prepared material containing the equivalent of 11.850 per cent. of potassium ferrocyanide and 22 pounds of slaked lime, these two having been well mixed. The precautions mentioned above were taken. The tank was filled to a certain height, and then, after having allowed the water to stand on it for 24 hours, it was drawn off below and the tank refilled anew with fresh water.

Day.	Degrees Beaume of the Water.	Quantity of Ferrocyanide Extracted in One Lixiviation. Oz.	Per Cent. of Total Quantity.	Per Cent. of Total Quantity Extracted.
1	7.8	213.74	51.0	51.0
2	3.2	99.33	25.0	76.0
3	1.3	37.63	9.0	85.0
4	1.0	11.77	3.0	88.0
5	0.85	7.13	1.7	89.7
6	0.80	5.83	1.4	91.1
7	0.70	4.70	1.1	92.2
8	0.65	3.32	0.8	93.0
9	0.60	3.00	0.7	93.7
10	0.60	2.82	0.6	94.3
11	0.50	2.54	0.6	94.9
12	0.45	2.40	0.5	95.4
13	0.45	2.22	0.5	95.9
14	0.40	2.05	0.4	96.3
15	0.40	1.76	0.3	96.6
30	nil.	traces.	traces.	96.6

Each day the liquid was analyzed. We were thus enabled to form the table above, in which the third column shows the quantity of equivalent potassium ferrocyanide extracted by each operation. The fourth shows the per cent. extracted each day. The fifth shows the per cent. extracted from the first day.

We see that the first lixiviations alone give practical results. The fifth day extracts only 1.7 per cent. On the thirtieth the chloride still gives a coloration, but analysis shows only traces of ferrocyanide.

In practice systematic lixiviation is used, and four wooden tanks are used, so connected as to allow a change in the order. The water after running through the four tanks stands at about 16° Beaumé for 15 per cent. strong material.

The liquid is run into tubs to settle. When clear it is pumped up to the concentrators. These in works of any size are two in number. The first which receives the fresh liquid is close, and the gases disengaged are passed through sulphuric acid.

When the liquid has evaporated to 20 or 25 per cent. it is run into the second one, where the evaporation takes place in the open air, there being no disengagement of ammonia or bad odors. Here it is concentrated to 40°.

The concentrated liquid is then sent to the crystallizing tanks. This operation takes some ten days. We thus get: Yellow perfect crystals, if the solution employed was clear; mother liquors which are evaporated to dryness, broken up and treated with water which is added to the leach liquor in the concentrators. These residues contain the impurities of the solution and the lime from the decomposition of the calcium sulphocyanide.

On small works the plant consists of a single concentrator, and this is open, being heated by a naked fire. The liquors are concentrated to 40°, and the ammonia is not saved.

Cost of Treatment.—The expense for treating an oxide containing the equivalent of 10 to 15 per cent. of potassium ferrocyanide, net average per ton, is as follows:

Labor	$2.50
Lime, 10 per cent	1.12
Coal, 275 lbs., at $4.65 per ton	.58
Interest, repairs, etc	.75
	$4.95

Details of the Second Method.—The mixture of the sponge with lime and the lixiviation are in all respects the same as with the first method. The solution of ferrous chloride and calcium ferrocyanide is mixed in wooden tubs, the mixture becoming a grayish mass. Mix well and allow to settle, which it does readily. After standing 24 hours, decant and keep the liquid for the sulphocyanides.

The paste remaining is scooped out and put on a cement floor, where it is drained and dried completely. While thus exposed to the air it oxidizes and turns blue. It is then put into barrels for shipment.

The solution of iron chloride is easily prepared by treating iron scrap with muriatic acid diluted with one-half its volume of water. This solution should be somewhat acid, since it is made with about 100 lbs. of iron to 360 lbs. of commercial acid.

The advantages of this method of procedure are the following:

It allows the easy collection of the sulphocyanides. The precipitation by the ferrous chloride taking place in the solutions of calcium ferrocyanide contain only traces of this substance, and the washing can be carried on more rapidly than with the preceding method, and with large quantities of water not being obliged to try to attain as high a degree of concentration in the liquor as possible. It is therefore a superior method.

Matters of Interest in Connection with the Washing of Crude Coal Gas.

[A paper read by Mr. Lewis T. Wright, before the Incorporated Gas Institute.]

In the following paper the author proposes to review the washing or scrubbing process employed for the abstraction of ammonia from coal gas, both from the theoretical and the practical sides; to show in what manner the operation is limited in its various stages by the properties of the ammonia compounds that are produced; to give some data that may he useful to his colleagues in controlling the efficiency of the apparatus; and to present facts hitherto unnoticed that may serve to suggest improvements in the details of the operation, and help to reduce the quantity of extraneous water employed—water that serves mainly to reduce the strength of the final product, and, by increasing its bulk, adds thereby to the cost of its transportation and conversion into sulphate of ammonia.

The author believes it would be possible, in many cases, by reducing the quantity of water introduced into the gas purifying process, to derive considerable advantage, both from the point of view of the illuminating power of the gas and also from the unnecessary bulk of gas liquor that has thereby to be dealt with. He has carefully tested in practice all theoretical suggestions, in order to give greater security to their application, and has endeavored to trace in the varying circumstances of practical examples the influences of the physical and chemical properties of the ammonia compounds that occur in gas liquor.

It is well known that the quantity of nitrogen—the keystone of ammonia—occurring in coal is not large, as it is also generally known that of this small quantity but a very small percentage afterwards appears in the crude coal gas as ammonia. Caking coal generally contains about 1¼ per cent. of nitrogen—rather less than more; and those coals that contain much less than that quantity (say, from 1 to 1.4 per cent.), are generally shales or cannels.

In the author's experiences, the caking coals contain from 1.56 to 1.9 per cent. of nitrogen; and of this amount the yield from 11.59 to 15.72 per cent. as ammonia on the distillation of the coal, according to the circumstances of the case. The proportion of the nitrogen so recovered is small, and yet it is important. The cannels generally contain less nitrogen and yield less ammonia on distillation. The same coal will not always, however, give the same amount of ammonia. The author's researches[1] show that the formation of this body is affected by the temperature. At very low yields of gas per ton, the amount is generally lower than at moderate yields. When the make of gas is very high, there is also a diminution in the amount of ammonia.

The following tables will give some information respecting the behavior of coals in regard to ammonia when distilled at different temperatures. The results were obtained as in practical work, and are the results of seven days average.

Caking Coal.				Cannel.	
Yield of Gas per Ton. Cubic Feet.	NH_3 per Ton of Coal. Lbs.	Yield of Gas per Ton. Cubic Feet.	NH_3 per Ton of Coal. Lbs.	Yield of Gas per Ton. Cubic Feet.	NH_3 per Ton of Coal. Lbs.
7,856	6.4	7,512	6.39	7,125	5.9
8,547	6.5	9,431	7.50	7,835	6.2
11,128	5.7	10,162	7.89	9,679	5.4
..	..	11,620	7.41	10,047	5.3

There are possibly other influences at work that affect the yield of ammonia.

In order to show the proportion of nitrogen in different samples of coal and the yields of ammonia, the following table is given of results obtained in practical working:

Caking Coals.

Percentage of Nitrogen.	Pounds of NH_3 per Ton.	Percentage of Nitrogen found as NH_3.
1.90	7.42	14.3
1.67	5.47	12.0
1.75	5.97	12.5
1.67	6.29	13.9
1.68	5.79	12.7
1.73	7.42	15.7
1.74	6.43	13.6
1.88	6.29	12.3
1.59	5.79	12.7
	Cannel Couls.	
1.28	6.1	17.6
1.46	4.8	12.1
1.37	5.2	14.0
1.28	4.9	14.2

1. See *Journal of the Society of Chemical Industry*, Vol. VII., p. 59.

There is a class of coal that is commonly called cannel but that is not strictly speaking a cannel coal more than in name. This coal is found in different seams and is large, hard, and bright, and has the appearance of cannel. On distillation, it intumesces and cakes. It is further characterized by containing but little ash, and is therefore free from the earthy matters that are the usual characteristics of cannel. It yields about 19-candle gas, and is probably caking coal that, being free from charcoal layers and other "partings," is harder and not so easily broken. This so-called cannel gives :

Percentage of Nitrogen.	Pounds of NH_3 per Ton.
1.7	7.8

And, therefore, as regards ammonia, as well as regards ash, illuminating power and coke, it behaves more as caking coal than as cannel.

In the case of coal containing 1.7 per cent. of nitrogen (an amount which may be taken as an average for caking coals), in order to give 7 lbs. of ammonia per ton of coal, it would have to yield 15 per cent. of its nitrogen in that form. But caking coal may very well yield less ammonia even when every care has been taken to avoid loss of this valuable product. It will be assumed in this paper that the yield of ammonia is 6.8 lbs. per ton of coal. This amount is equal to 1.5 per cent. of the gas by volume, or 476 grains per 100 cubic feet in the gas as it leaves the retorts and before it commences to condense.

Accompanied with this alkali, there is a large amount of acid gases—viz., carbonic and hydro-sulphuric acids. The amount of these two acids that play so important a part in the washing process, varies much indeed according to the nature of the coal. The finest Yorkshire and Newcastle coals give the least carbonic acid. The Derbyshire Silkstone and Scotch splints give notably more, and the cannels generally very large quantities of carbonic acid. Of sulphureted hydrogen, the cannels generally give the lowest amounts.

The following table gives the amounts of these impurities in various classes of coal :

Impurities in Condensed but Unwashed Gas.

	Carbonic Acid.		Sulphureted Hydrogen.	
Class of Coal.	Grains per Cu. Ft.	Volume Percentage.	Grains per Cu. Ft.	Volume Percentage.
Newcastle.....	12	1.5	9	1.4
Yorkshire Silkstone...	12	1.5	8	1.3
Derbyshire " ...	12 to 19	1.5 to 2.3	6 to 12	1 to 2.0
Cannels.....	30	3.7	3 to 6	0.5 to 1.0

The quantity of both these impurities is increased when the temperature of distillation employed is increased, as will be seen in the following table :

Caking Coal.

Yield of Gas per Ton.	Grains of CO_2 per Cubic Foot.	Grains of H_2S per Cubic Foot.
7,856	16.92	3.16
8,547	18.38	4.69
11,128	19.37	5.87
	Cannel Coal.	
7,853	32.60	4.80
10,047	39.27	4.97

Though the ammonia in the gas is always accompanied with more than enough acids for its saturation, yet it is not combined with these acids so long as it remains in the gaseous condition. But any water that condenses from the gas containing ammonia, or that has been otherwise in contact with such gas, and therefore also contains ammonia, will contain both carbonic and hydro-sulphuric acids, and is not a solution of free ammonia, but a solution of salts of ammonia—salts formed by the combination of this body with different proportions of the two acids in question.

As types of the class of compounds that ammonia forms under these circumstances with the two acids in question, it will suffice for the moment to consider the two carbonates—the neutral carbonate $(NH_4)_2CO_3$, in which two volumes of ammonia are found combined with one volume of carbonic acid, and the acid, or bicarbonate, in which one volume of ammonia is combined with only one volume of carbonic acid. Thus, according to the salt formed, or if both salts be formed according to the quantity of each, so will one volume of ammonia be accompanied with either half a volume or a whole volume of carbonic acid, or an amount between half a volume and one volume in the case of mixtures of the two carbonates. In the same manner, there are two similar compounds of ammonia with sulphureted hydrogen or hydro sulphuric acid. It will be interesting to know in what proportion the ammonia combines in practice with these two weak acids. The two acids are both called weak acids, as they are easily displaced from their combinations by stronger ones ; but the sulphureted hydrogen is by far the weaker of the two. The ammonia thus combined is technically known as "free" ammonia. This expression is quite incorrect, however convenient it may be. It, however, has become ingrafted in our technical phraseology, and serves to distinguish the ammonia that is combined with the two weak acids—carbonic and hydro-sulphuric acids—from some, and a not unimportant quantity, that is combined with stronger acids. The compounds of ammonia with carbonic and hydro-sulphuric acids are destroyed at a temperature under that of boiling water, and the ammonia that they contain can, in consequence, be expelled from their solutions by the simple action of boiling. But, at the same time, the liberated acid gases are also expelled ; and thus if the ammonia be recondensed in water, the carbonic and hydro-sulphuric acid also condense, just as in the original formation of the gas liquor from the gas, and the ammonia compounds are re-formed. Thus the operation of boiling does not result in the final separation of the alkali, ammonia, from its attendant acids, but only to disunion, though owing to the somewhat greater facility with which the acid gases leave the heated solution, the proportion of acid to the ammonia can be reduced by a simple distillation and recondensation in water of the ammonia. Thus it must not be understood from the use of the term "free" ammonia that the ammonia in question is free and not combined, but only that it is united to weak acids. There is a further amount of ammonia, principally as ammonium chloride, or sal ammoniac, equal to from about one-fourth to one-fifth of the total ammonia. The chlorine that furnishes this sal ammoniac is originally contained in the coal, and in the distillation is evolved as hydrochloric acid. This body forms the "salts" that are often found mixed with tar in the hydraulic or foul mains where the temperature is high.

It will be interesting to know what volume of the acid gases in question can combine in practical conditions with ammonia. The author has investigated this subject and finds that the amount depends on the degree of concentration of the gas liquor, and the temperature at which it is formed. It will be found in practice that in gas liquor of average strength, the so-called "free" ammonia is combined in the following proportions : For every 100 volumes of ammonia there are from 60 to 70 volumes of the carbonic and hydro-sulphuric acids.

The following table will show in what manner this so called "free" ammonia is combined :

	Per 100 Volumes of Ammonia.		
Strength of Liquor. Ounces Saturation.	Vols. of CO_2.	Vols. of H_2S.	Vols. of CO_2+H_2S.
28.0	49.0	8.0	57.0
12.0	51.5	11.3	62.8
7.5	52.4	15.3	67.7
2.7	50.0	24.0	74.0
0.2	35.0	45.0	80.0

It will be observed that the weak liquor contains decidedly more acids in proportion to the so-called "free" ammonia than the strong liquors, but that the increase is due to the increase of the weaker acid—viz., sulphureted hydrogen. With the ordinary strengths, there is not a notable difference in the proportion of carbonic acid, which is the impurity that is expensive to remove. It will be observed also that the amount of acids relatively to the ammonia is larger than that required by the class of compounds $(NH_4)_2CO_3$ and $(NH_4)_2S$, or those of two volumes of NH_3 to one volume of CO_2 or H_2S, but not nearly large enough for the compounds $(NH_4)HCO_3$ and $(NH_4)HS$, or those of one volume of NH_3 to one volume of CO_2 or H_2S.

The proportion of the acids varies with the temperature of the formation of the liquor. For that reason, slight differences will be found at different seasons of the year.

As regards the influence of temperature, it will be found that at a low temperature there are more acids combined with the ammonia than at a high temperature, though the difference is not very important till a temperature of about 170° F. is reached. It happens, however, in gas works, that in the case of gas liquor produced, for instance, in the hydraulic main, that for every 100 volumes of the so-called free ammonia, there are only about 35 volumes of the two acids in question, of which 24 volumes will be carbonic acid and 11 volumes of sulphureted hydrogen. Thus when such liquor is cooled and used in the scrubbers for washing the gas, the ammonia it contains is able to combine with a further 30 volumes of acid gases, of which about 20 volumes will be carbonic acid and 5 volumes will be sulphureted hydrogen.

The composition of the liquor from the condensers having a mean temperature of condensation higher than that of the finished gas, will also exhibit the influence of high temperature in containing a low proportion of carbonic and hydro-sulphuric acids to the so-called free ammonia present. Its composition will, of course, depend upon the mean temperature at which it has been formed. This liquor, besides being

able to absorb more ammonia, will also be able per 100 volumes of so-called "free" ammonia originally present, to add a further 10 or 15 volumes of acid gases, which will consist principally of carbonic acid. This acid, except in the case of liquors of extreme dilution, is always the predominant partner.

Since, in the final product, 100 volumes of the so-called "free" ammonia are combined with but about 65 volumes of the acids, it will be seen how, even in the case of coals yielding the lowest amount of these, the ammonia is clearly insufficient to effect the removal of more than a small part of these impurities from the gas.

Of the total volume of ammonia in the gas, which will not much exceed 1.5 per cent. in any case, one-fifth will be found in the liquor combined with the hydrochloric and other strong acids; and there will be therefore only 1.2 per cent. left for combination with the carbonic and hydro-sulphuric acids—an amount only equal to the removal of 0.6 per cent. of carbonic acid and 0.18 per cent. of sulphureted hydrogen—quantities that appear very small in relation to the total, especially in regard to such coals as those like the Derbyshire and Scotch splint coals and cannels, giving from 1.5 to 3.7 per cent. of carbonic acid.

It is commonly stated that water at ordinary temperatures absorbs 700 times its volume of ammonia gas; but this mode of stating the case, when taken in conjunction with the operation of washing or scrubbing, is deceptive and requires qualification, as the circumstances under which water absorbs 700 times its volume of ammonia gas are not such as occur in gas manufacture.

The quantity of ammonia gas that water can absorb is dependent, among other things, on the pressure of the ammonia gas; and in order to make the common statement intelligible, it is necessary to add that water at ordinary temperatures absorbs 700 times its volume of ammonia gas when the pressure of the ammonia gas is equal to that of ordinary atmospheric pressure.

Since the quantity of ammonia in the crude gas is only 1.5 per cent. by volume, its pressure can only at the maximum be 1.5 per cent. of the total pressure of the gas, which is practically atmospheric pressure, and is therefore only equal to about 0.45 inch of mercury. The following table will show the quantity of ammonia absorbed by water at various *pressures of ammonia*, and is borrowed from Sims:

Ammonia Absorbed by Water at Different Pressures at 68° F.

Pressure Inches of Mercury	Grains of Ammonia per 1 Grain of Water.
0.00	0.119
3.94	0.158
7.87	0.232
11.81	0.296
15.75	0.353
19.68	0.403
23.62	0.447
27.56	0.492
31.50	0.535

Not only has a solution of ammonia a tension that varies according to its strength and temperature, but the solutions of its easily dissociable compounds with carbonic and hydro-sulphuric acids have in the same manner a tension of ammonia—a tension that exerts a very important influence in the operations attending the removal of ammonia from the coal gas by scrubbing or washing with gas liquor or water.

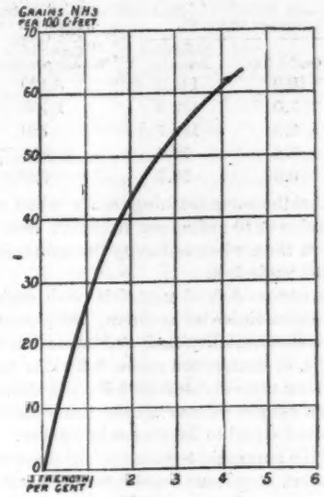
The maximum tension of ammonia gas in coal gas is only about 0.45 inch mercury; and we have consequently to deal with tensions that are too small to be shown with clearness in the above table, which is only inserted in order to show how the ordinary method of stating the case is wanting in completeness.

Since the ammonia tensions of gas liquor are relatively low, it is not convenient to express them in the usual way, of height of the column of mercury that balances them. It is better to state them in grains of ammonia per 100 cubic feet of coal gas.

However, since in coal gas the ammonia gas is always accompanied by an excess of acids, the liquor that condenses from the gas, or is otherwise produced, is not, as has been mentioned before, a solution of ammonia, but a solution of ammonia salts.

The major part of these ammonia salts—viz., those of ammonia with carbonic and hydro-sulphuric acids—are of an exceedingly unstable character, and in an incipient state of what is called dissociation.

The practical effect of this ready dissociability of the ammonia compounds in question is a tendency for their solutions, such as is gas liquor, to lose the gases of which they are composed. But this loss is limited by their pressure in the atmosphere in contact with the gas liquor. Thus, just as the strength of a solution of ammonia in water is dependent upon the pressure of the ammonia gas with which it is in contact, so is the strength of the gas liquor dependent on the pressure exerted by the ammonia in the crude coal gas with which the liquor is in contact; and conversely, the pressure of the ammonia in the crude coal gas, or its proportion, is dependent on the strength of the gas liquor with which it is in intimate contact.



There is for every strength of gas liquor and for every degree of temperature (the strength in this case being on the so called "saturation" basis) a certain pressure of ammonia that will balance its tendency to lose ammonia; and thus a gas liquor in contact with coal gas will lose ammonia (and at the same time also carbonic acid and sulphureted hydrogen) if its quantity or pressure in the gas be less than the balancing pressure required. If, however, the pressure of ammonia in the gas be larger than that required to balance the tendency of the gas liquor to lose ammonia, then the latter will gain in strength, and abstract ammonia from the gas, until the ammonia pressure remaining balances that exerted by the liquor.

A practical example will serve to immediately illustrate this property of gas liquor. At a temperature of 60° F. a gas liquor of 14-ounce strength saturation cannot reduce the ammonia in the gas it is in contact with to a lower amount than 54 grains per 100 cubic feet. (In this case it is more convenient to express the amount of ammonia on the usual basis of grains per 100 cubic feet; 54 grains is equal to nearly 0.2 per cent. by volume.)

The tension of pressure of ammonia that will balance that of any gas liquor varies with the strength of the liquor and the temperature. The tension increases with the temperature. For instance, the strength of liquor above mentioned—viz., 14-ounce—will be balanced at a temperature of 70° F. by an amount of ammonia equal to about 70 grains per 100 cubic feet. Liquor of a degree of concentration so low as 1 ounce saturation exerts a degree of ammonia pressure at 60° F. that is considerably over that allowed, for instance, by the London Gas Referees.

It frequently happens in practice that a portion of the scrubbing plant is used with a strength of gas liquor that at that point is not only unable to reduce the quantity of ammonia in the gas, but even serves to increase it. It must not be thought that because coal gas has been washed until it no longer has an alkaline reaction to delicate litmus paper, that the gas is thereby entirely free from ammonia. The author has found that the large proportion of acid gases present will mask the alkaline reaction of ammonia when it is present to the extent of about 2 grains per 100 cubic feet. It may be that the gas is being "scrubbed" apparently free (so far as regards the test paper) from ammonia; and this accumulates, where lime is used, as uncombined ammonia in the purifiers, and on a warm day may be given off again, thus producing a sudden rise in the ammonia impurity. It is not, as has been commonly thought, that ammonia has been synthesized in the purifiers, but that it was passing the scrubbers indistinguishable on the test paper owing to the excess of acid gases. Theoretically, it would appear that the larger the proportion of ammonia in the gas the easier it should be to take out a certain fraction of it. Thus, from gas containing 100 grains of ammonia per 100 cubic feet, it should be much easier to remove 10 grains than it would be to remove that amount from a gas that contained but little more than 10 grains. The chances of the water coming in contact with ammonia would be 10 times as great. This is very observable in practice in the case of gas containing but very small quantities of ammonia.

This greater facility with which it is possible, in the same space and under otherwise the same circumstances, to remove ammonia of high tension, will be seen by an inspection of the table below, which is obtained from trials carried out with a mechanical washer:

Ammonia, Grains per 100 Cu. Ft.			Cu. Ft. of Gas Washed per Cu. Ft. Gross Capacity of Washer per Diem.	Grains of Ammonia Removed per Cu. Ft. Gross Capacity of Washer per Diem.
Inlet Gas.	Outlet Gas.	Difference Removed.		
124.0	10.0	114.0	3,120	3,557
136.0	7.0	129.0	1,750	2,257
142.0	2.3	139.7	780	1,090
80.0	1.4	78.6	815	640
24.3	0.6	23.7	680	161

It will be seen that the same washing space when reducing the ammonia from 124 grains to 10 grains per 100 cubic feet could do nearly six times more work than when reducing the ammonia from 80 grains to 1.4 grains per 100 cubic feet.

The fact that the compounds of ammonia with carbonic and hydrosulphuric acids are dissociable at ordinary temperatures, and that in consequence of this dissociability their solutions exert an appreciable ammonia tension, is, of course, the reason why it is necessary to introduce into the washing process extraneous clean water, since the natural liquor from the coal cannot remove all the ammonia from the gas, but must leave an amount equal to its ammonia tension.

A knowledge of the ammonia tensions of gas liquors of various degrees of concentration, at various temperatures, would render it possible to calculate for every case the least amount of water theoretically necessary to wash the gas clean.

To quote a case: The natural liquor from the coal is used for washing the coal gas at 60° F., until its ammonia tension balances that of the gas. It is then of 14-oz. saturation strength; and the ammonia in the gas is equal to 54 grains of ammonia per 100 cubic feet. The natural liquor can now do no more work. The clean water employed to remove the remaining ammonia can be brought up to 14-oz. saturation strength, but not to any higher strength; and it is required to know what quantity of water must be employed.

Supposing that no ammonia becomes "fixed," so that all will appear in the saturation test, it will be found that the water required will be 2.54 gallons per ton of coals carbonized. Thus: The 54 grains per 100 cubic feet, if the coal is yielding 10,000 cubic feet of gas per ton carbonized, will be equal to 5,400 grains of ammonia per ton; or, 0.771 lbs. 14 oz. saturation is equal to liquor containing 3.035 per cent. by weight of ammonia, supposing the liquor to have the gravity of water.

If x be the pounds of water to be employed to give the liquor of 3.035 per cent. strength, or 14 oz., we have—

$$\frac{x \times 3.035}{100} = 0.771 \text{; or } x = 25.4 \text{ lbs.}$$

Thus, in such a case, it should theoretically be possible to complete the washing of the gas with about 2½ gallons of clean water per ton of coals. The average quantity employed in practice is considerably more.

It is commonly stated that the strength of gas liquor in terms of degrees of Twaddel's hydrometer can be converted into ounces by multiplying by two. The author has investigated this matter, and finds that the usual factor of two applies fairly well to the finished product, and then gives ounces distillation. For natural liquors—viz., those produced directly from the coal without the addition of any clean water—the factor of two does not apply very well, being very much too low for ounces distillation. For the liquors obtained from clean water scrubbers and washers—liquors that do not contain much so-called fixed ammonia—the factor is too low.

Class of Liquor.	Degrees Twaddell.	Strength of Gas Liquor. Ounces. Saturation.	Strength of Gas Liquor. Ounces. Distillation.	Factor. Ounces per Degree Twaddel. Saturation.	Factor. Ounces per Degree Twaddel. Distillation.
Natural.....	4.00	8.72	10.20	2.18	2.54
"	6.16	11.09	14.96	1.80	2.43
" (cannel coal	3.88	6.52	8.63	1.68	2.22
Final product.....	6.30	10.20	12.60	1.62	2.00
"	6.45	10.80	13.20	1.68	2.04
"	5.25	8.30	10.10	1.59	1.92
From clean water scrubbers.....	4.80	—	8.81	—	1.83
	2.95	—	4.83	—	1.64

The term final or finished product is applied to the output from the gas works as sent to the liquor works, containing the natural liquor from the coal and the clean water added for washing. Solutions of the commercial carbonate of 6° Twaddel require to be multiplied by 2.15, and of 10° Twaddel by 2.13, to reduce them to "ounces"—in this case saturation or distillation indifferently. Solutions of sal ammoniac of about 6° Twaddel require a factor of 2.4 to convert degrees Twaddel into ounces distillation.

Discussion.

Mr. A. Dougall (Tunbridge Wells) said this was a most interesting paper, which gave the results of a very careful study of the washing of crude gas, but it did not show how they could profitably recover more of the nitrogen in the form of ammonia than at present. The author had advanced theories which explained scientifically the process of washing. These would amply repay careful study, and no doubt the paper would enable them to effect considerable economy in the use of lime. One point in which he (Mr. Dougall) was specially interested was the reduction of the quantity of clean water used. If they could recover the whole of the ammonia by the use of natural liquor and a few gallons of clean water, managers who sold their liquor would be under a great advantage, and many of those who were at present debarred from manufacturing sulphate of ammonia because of the difficulty of getting rid of the spent liquor would be able to evaporate the whole of it in the ash pans, because there would be so very much less to dispose of.

Dr. Stevenson Macadam (Edinburgh) thought that the paper was likely to yield very good practical results. The reference made to the comparatively small proportion of ammonia extracted from coal in the process of distillation, and the large proportion left in the coke, naturally suggested the question as to whether there was any method by which a larger proportion of the ammonia could be extracted. He did not think it would be a loss, as Mr. Wright put it, that a larger proportion should be extracted; for, though it might bring down the price of sulphate of ammonia a little, that was not so much regulated by the amount produced as by the quantity of nitrate of soda that came into this country, and which, containing as it did a large proportion of nitrogen, could be used practically for manurial purposes in the place of sulphate of ammonia. It had been found—and he left it to practical men to devise means to carry it out—that if steam were introduced along with air into the coke from such works a very much larger proportion of ammonia could be obtained. Experiments had been made in shale works, where the increase of ammonia was most marked. The passage of steam and air through the coke resulted in an increase sometimes of 100 per cent., and sometimes of 50 per cent., in the ammonia, and possibly some method of this kind could be introduced into gas works, whereby a large increase in the ammonia could be obtained. With regard to the conditions in which ammonia might be present in the gas liquor, he quite agreed with the author of the paper that the most likely proportion of the ammonia to the carbonic acid was that of two volumes of ammonia to one of carbonic acid—that was the combination most likely to be formed. But, with respect to the sulphide combination, he should consider the proportion of one volume of ammonia to one of sulphureted hydrogen was the most likely condition—not the proportion as indicated in the paper of two volumes of ammonia to one of sulphureted hydrogen. It was recognized in chemical laboratories that the former combination was the most likely to be produced under the circumstances. He thoroughly agreed with the method of washing which had been suggested by Mr. Wright, and he thought the paper would be of great assistance, when put into practical shape, in rendering the gas more readily purified by means of the various liquors there—viz., gas liquor or clean water.

Professor Ivison Macadam (Edinburgh) drew attention to the large amount of nitrogen lost in the tar as a point which required a little working up, and might fairly be considered when dealing with the yield of ammonia per ton. The amount of nitrogen found in tars—both in gas works and paraffin works tars—varied considerably. The compounds were mostly of an alkaloidal or a compound ammonia type. These compound ammonias they had not yet been able to work up satisfactorily in the paraffin works. The loss of nitrogen from this source alone was considerable, and it required to be taken into account along with that found in the gas when attempting to account for the whole of the nitrogen in coal.

Mr. C. S. Ellery (Bath) was not quite sure whether the point he was about to raise was made clear in the paper, but as one manufacturing sulphate of ammonia, the question had been running in his mind whether by re-using the liquor the result would not be to increase the quantity of fixed ammonia, so that the cost of treating the liquor in order to ultimately recover the ammonia would not be very much greater than at present. It seemed important to have as much ammonia in the free form as possible, consistent with proper washing. He thought it would be well if Mr. Wright would give some idea as to the washer used in the experiments he had referred to. They all knew that by different washers, and in different methods of using the same washer, the

results obtained vary very much—at any rate, the sort of washer employed largely affected the question. If gas were first washed with strong liquor, as was his practice, and then passed through a washer with clean water—where they were not inconvenienced by the quantity of water used on the premises—the whole of the ammonia was removed, and they were spared the difficulty of dealing with what must be, under this treatment, a very large percentage of fixed ammonia in the liquor.

Mr. D. Irving (Bristol) said in this paper, as in all his work, the author had by practical experiment thoroughly substantiated what he brought forward, and they were much indebted to him for the data he had furnished. The method of washing as suggested was exactly that adopted at the Stapleton Road works of the Bristol Gas Company. The whole of the liquor produced from the hydraulic mains and the condensers, containing a large proportion of free ammonia, was afterwards used in the washers. The washer employed had a number of compartments, and a considerable quantity of carbonic acid and sulphureted hydrogen was taken up in the manner suggested by Mr. Wright, and the fact that, in ordinary working, they succeeded in removing the whole of the ammonia with the addition of about three gallons of clean water per ton of coal, and kept the ammonia at the last scrubber outlet down to .3 or .4 grain per 100 cubic feet, showed that they approached very nearly to the theoretical work capable of being obtained from the 1½ per cent. of ammonia contained in the crude gas. It would have been interesting if Mr. Wright could have made any suggestion as to how the large proportion of 85 per cent. of nitrogen in the coal could be converted into ammonia, and he (Mr. Irving) thought they would all be willing to take their chance of disposing of it profitably on the market. He should be glad if Mr. Wright would state the method employed in testing the ammonia in crude gas. He (the speaker) had found great difficulty in getting regular results, though he had taken the greatest care, and often he had to reject results, because they were apparently so unreliable.

Mr. Wright, in reply, said that Mr. Dougall was quite correct in saying that, with attention to the principles which underlay the combinations of ammonia with carbonic acid and sulphureted hydrogen, it would be possible by careful study to reduce the quantity of cold water constantly employed for washing gas. He was glad to hear of Dr. Macadam's operations, because he reminded them that it was possible by methods either known or indicated to increase the amount of ammonia which coal yielded on distillation. Whether it was profitable to adopt any of those methods, he expressed no opinion. Sir Humphry Davy once said, when the duties of men coincided with their interests they were performed with alacrity, and he (Mr. Wright) had no doubt that, when the interests of the gas industry coincided with the duty of converting more of the nitrogen of coal into ammonia it would be performed with alacrity. As regarded what Dr. Macadam said about nitrogen in the tar, there was no doubt that in the tar there went away from the works a great quantity of ammonia combined with the chlorine, the hydrochloric acid, and the sal ammoniac, and in the hydraulic mains, or in the inlet of the condensers, one often came across large patches of ammonia salts which were really sal ammoniac, and this sal ammoniac went down to the tar works very often with the tar. He met an engineer the other day who said that he meant in future to be paid for this ammonia, but whether he would succeed in getting paid for it, he (Mr. Wright) did not know. The manner in which the 1½ per cent. of nitrogen usually contained in the tar was combined had up to the present time made it unprofitable to recover it. As regarded Mr. Ellery's question, whether the re-use of ammoniacal liquor, as in the Hills and Claus washing processes, would increase the fixed ammonia, he (Mr. Wright) must say it did somewhat, but not to any extent which would render these processes unprofitable if they were convenient on other grounds. Unquestionably in the cooling and repeated re-distillation of gas liquor as employed in the Hills, Claus, and similar purification processes, there was a gradual growth of fixed ammonia in the liquor. With regard to the large proportion of nitrogen which was not recovered on distillation, some was left in the coke and some went in the tar. He thought he might answer Mr. Irving's question with regard to the quantity of nitrogen in replying to Dr. Macadam's remarks. That gentleman told them, and he quite agreed that one would suppose theoretically that the compound formed between the ammonia and the carbonic acid would be as two volumes to one, but he also said that, as regarded the sulphur compounds, he should expect to find in both one volume of ammonia with one volume of sulphureted hydrogen. If Dr. Macadam would look at the fifth table in the paper, he would see that in the case of weak liquors that tended to be the case—carbonic acid was the stronger acid of the two. But when the liquor was extremely dilute, the carbonic acid did not tend to displace the sulphureted hydrogen to the same extent as in a stronger liquor, and, consequently, in weak liquor there was a larger quantity relatively of sulphureted hydrogen combined with the ammonia.

[Official Report.]

THIRD ANNUAL MEETING OF THE PACIFIC COAST GAS ASSOCIATION.

Held in San Francisco, Cal., July 16 and 17, 1895.

First Day—Morning Session.

The Association was called to order at 10:30 A.M., July 16th, the President, Mr. C. W. Quilty, of San Jose, in the Chair.

ROLL CALL.

The roll call disclosed the presence of the following members:

H. E. Adams, Chas. R. Allen, Chas. F. Adams, W. G. Barrett, Jno. A. Britton, E. P. Callender, Walton Clark, A. Carrigan, Jno. Clements, J. D. Collins, C. M. Converse, F. A. Cressey, S. B. Cushing, J. G. Eastland, F. H. Eichbaum, R. Fenner, L. F. Fogg, C. Froelich, W. W. Gillespie, C. M. Gregory, R. P. Grear, J. B. Grimwood, S. Guthrie, J. L. Howard, E. C. Jones, J. C. Kaneen, G. Keating, B. A. Knight, J. Kullman, H. T. Lally, H. J. Lewelling, Jas. McNeil, P. Meyer, C. O. G. Miller, M. C. Osborn, T. R. Parker, C. W. Quilty, E. C. Randall, D. R. Russell, Jno. S. Scott, J. L. Stewart, L. P. St. Clair, F. J. Symmes, G. H. Taylor, Jno. W. Thomas, Geo. Thompson, Thos. Thompson, J. B. T. Tuthill, A. J. Vanderwhite, A. B. Williams, G. W. Wilson.

The President announced that the minutes had already been published in the gas Journals, whereupon, on motion of Mr. Eichbaum, they were approved as published.

The President then read the following

INAUGURAL ADDRESS.

Gentlemen: This is the third annual meeting of the Pacific Coast Gas Association. As President of the Association for the past year, I am supposed to review and lay before you all matters appertaining to general gas interests during the term of my incumbency, and further to particularly review matters of special interest to the gas investments of the Pacific Coast.

In doing so I will speak from my individual, private experience, rather than officially as President of this Association. I shall not attempt to elaborate on the advancements and improvements made in the lighting business during the past year, because that will be the work of talented, experienced and well informed members of this Association, who will present special papers on different branches of the lighting business.

In speaking of the gas interests I trust you will allow the President a latitude beyond that apparently fixed by the name of this Association, and permit me to speak on electrical and other matters which at the present time affect our gas interests.

Turning our attention to the gas business of the Pacific Coast, I will say that the past year has been one of growth, improvement, prosperity and confidence. New gas companies have been established, more mains and services laid, and more gas manufactured than in previous years, and a decided improvement made in the quality of the gas sent out and the prices charged greatly lessened. It has been a prosperous year; we hear of commercial enterprises failing and banks suspending, but no gas company on this Coast has passed into the hands of a receiver, nor have I heard of one stopping its dividends. While this has been a year of suspicion of almost all kinds of enterprises and investments, gas stocks and securities have gained in the public confidence until they command the preference. Capitalists and banks uniformly loan on stocks of well established gas companies in preference to other corporate securities.

The process and materials used in the manufacture of gas on this Coast are the well known coal and oil gas processes. Most of our coals are imported. This State, however, furnishes oils in large quantities, the distillates of which, and some of the finer and lighter natural petroleums of home wells, are used in the manufacture of gas. Of late large quantities of petroleum have been imported from South American States for that purpose. These processes of gas manufacture are so well known that I will not dwell on them, further than to say that works of such capacity and efficiency have been constructed by the San Francisco Gas Light Company, and so well managed that gas is now being furnished to consumers practically as cheap in San Francisco as anywhere in the United States. Oakland, Los Angeles, San Jose and other California cities have also reduced the prices of artificial gas to that point that it is used in large quantities for purposes other than illumination. The different methods of manufacture of gas, whether by old style of retorting, or regenerative benches, or by combination of coal and oil process, or the different oil processes growing out of the fundamental

principle of the Lowe invention, are the subject of special papers. However, those methods of manufacture are so well understood that gas is sold as cheaply here, comparatively, as anywhere in America.

This cheapness of cost brings us again to its uses. Its primary use is for illumination; its convenience has made it almost a necessity. With the Welsbach burner it is superseding electric light—at this time it may be in place for me to say that Mr. E. C. Randall, of San Jose, will read a paper founded on his very successful experience with the Welsbach light at San Jose—its further uses are for cooking, manufacturing, power, etc. Our climate is so equable that a gas stove is a welcome domestic household article the year round. We have no Eastern winters requiring the firing of heaters and stoves with anthracite coals during six months of the year. It is used for running gas engines and for retorting, and the reduction of ores, metals, etc., for furnishing power and generating electric light. There are two places in California where coal gas is used to manufacture electric light. In England several electric light stations are equipped with gas engines, and in France gas engines as high as 500-horse power are in use for that purpose. So we may conclude that the gas industry, the construction of improved works, the process of manufacture, and the many uses in which gas is being profitably employed are well understood by the companies represented by the members of this Association.

Being, then, satisfied that we are abreast of the times in the manufacture, uses and sale of gas, we next inquire into the commercial and financial conditions of the lighting business. As I have said before, nearly all of our present companies are paying properties, and, if permitted to operate in the future as in the past, are stable investments. However, of late there have been discoveries and inventions made, and social and economic questions have arisen, which may vitally affect the enormous financial interests of the gas business on this Coast. Among the discoveries is that of acetylene, a gas which has many times the illuminating qualities of coal gas, which requires no expensive system of works for its manufacture, and which, it is said, can be made much cheaper than ordinary illuminating gas, and can be made in small quantities by families, and so used locally independent of any large company. It is not within the province of my address to go into the technique of the chemistry and physics of its manufacture, but simply to call your attention to the fact that in a State like this, with streams furnishing thousands of horse power, in their mad rush for the embrace of the sea, streams which part on one side cliffs and pinnacles of limestone, and on the other uncover huge beds of fair quality of coal, that nowhere else in the world are the materials, conditions and elements more favorable for the cheap—exceedingly cheap—manufacture of acetylene gas than right here in the State of California. Gas engineers and superintendents need bestir themselves. On this subject of acetylene gas, E. C. Jones, Esq., Superintendent of the San Francisco Gas Light Company, will read a paper; and from his experience, ability, earnestness and pride in his profession, this meeting may expect a professional and literary treat.

Analogous to cheap acetylene gas, and among inventions and discoveries affecting gas interests, is the utilization of the many great water powers of the Coast States and the development and transmission of electricity for long distances.

The generation and use of electricity as before outlined in competition with gas have long passed the experimental stages. There are many towns and cities on this Coast furnished from distant streams with electricity for lighting power and manufacturing purposes. In fact, the plants installed are the largest in the world, with the solitary exception of Niagara. The Portland, Oregon, and Folsom plants are the largest on the Pacific slope. There are many other enterprises of that kind, however, in this State; notably at Eureka, Redding, Red Bluffs, Los Gatos, Watsonville, Monterey, Redlands, Ventura and San Bernardino.

The social and economic condition which affects gas interests and investments is the growing tendency toward municipal ownership and control. Municipal ownership and control tower above all other dangers to investments of this character. Acetylene gas may be met with acetylene gas, and electricity may be made to compete with itself, and competition may be compromised with something saved; but when the question of municipal ownership arises, like a dismal fog and a dark cloud in a night, and from God knows where, then is begotten the feeling of despair and the fear of impending doom. Municipalities are generally—I may say always—controlled by men who care no more for vested interests than a Cossack does for a peasant's lamb, or a stage robber for a keepsake; especially where corporate interests are concerned is the most indifference shown. No consideration is shown for the capital invested, the rights affected or the results to the municipality. It is the fashion now for promoters to come along, and where everything is quiet and working satisfactorily to the corporation and to the people, to stir up the city trustees or council, by bribes or other inducements, to own a municipal gas plant or water plant. The papers take the matter up, a great noise is made, the people are aroused, no genuine attempt is made to buy out the existing company. No; that would't do! Huge blocks of bonds are voted, a contract is let to some figurehead outsider, who builds a shotgun works, sells the bonds and pockets the coin. The city is involved, the old company "cinched," and the citizens taxed to death.

Wherever there is a wrong Blackstone says there is a remedy; but in a case of this kind there is no remedy. There is no law in the codes protecting a gas company. There are only three sections in the codes that refer to the gas business. There is plenty of law for every other business interest, trouble or enterprise, from marrying couples to registering births of babies, and from fish peddling to railroad building; but there is no law to protect the gas business from semi-public robbers. In this connection I have prepared a bill which should become a law. It will be distributed in pamphlet form among our members.

The question of municipal ownership is an appalling one to legitimate enterprises of our kind. It presents a grand, alluring, kaleidoscopic scheme which partakes of paternalism, socialism, populism, and the Gallic theory of equality and fraternity. Demagogues want public works that their henchmen may run them and fatten on them; boodle politicians want municipal works that they may swing and vote the employees, and levy political assessments. The rabble and unthinking citizens want municipal works, because led to believe that light and water will cost next to a mere nothing. The result is that thousands of dollars of bonds are voted and a works built and the taxpayers pay three times for their light. First, they pay the interest to the foreign bondholder; second, they pay out of all reason for cost of manufacture and maintenance; and, third, they pay for stealings, corruption and waste. I have thoroughly examined the question of municipal ownership, have examined statistics from our own cities, from those of England and of Germany, and I can say that, with one or two exceptions, municipal ownership has been a dismal failure and a wide-spreading evil. This one subject is worthy of a thesis itself.

We have thus far considered the growth of gas interests and the conditions affecting them favorably and unfavorably. The question now presents itself: What is the Pacific Coast Gas Association going to do about these weighty questions?

Of course our Association is young yet; it is only two years of age up to date. Our existence has been one of organization, of acquaintance and enlightenment in the arts and processes of our business; but now is the time for advancement and for action. No one can dream of the tremendous power and far-reaching influence of the work of a few determined men intelligently united to accomplish a result. This organization, through the desultory and intermittent efforts of its individual members, can accomplish but little, but with an executive committee of able and determined men, backed by the financial and moral force of the organization, we can be a power in the land for advancement and protection. This is a matter which may be taken up for consideration as a part of the business of the meeting. Likewise there should be an arbitration committee, composed of the oldest and most experienced members, for the purpose of putting a stop to foolish, insane and cut-throat competition, and to adjust conflicting interests.

I will now close, gentlemen, by saying that I have attempted to review as briefly as possible the large interests and investments in the gas business on this Coast, the materials and processes used, the extensions of the various systems, the many uses to which gas is put, the present desirability of gas stocks as investments and securities, and likewise have called your attention to the discoveries and inventions likely to affect those interests, and have referred further to the transmission of electricity in competition with gas; and, lastly, have directed your attention to the threatening evil of municipal ownership.

I will now say in conclusion that we must rise to the occasion and meet the necessities of the hour. We must conduct our business competently, and use the latest and best processes, so that consumers may have superior service at reduced cost, so that no municipality can complain that it is forced into a questionable commercial enterprise foreign to the political and civil theories of our government. If acetylene is the coming gas, let us adopt its use, and so arrange our systems and affairs to furnish it for general use cheaper than the individual could ever hope of producing it. If the finger of science still points forward and upward, and bids us rise above the use of material and matter for the production of light, and bids us seek the high Sierras and wrest from the rushing waters as they leap from their granite beds that subtle, imponderable, universal fluid, electricity, which Franklin drew from the clouds, which cannot be dissolved, dissociated or destroyed, and which is typical of life itself, and with it directs us to illumine cities in valleys far away, drive the machinery of mills and factories, propel the swift train, and from our promontories, capes and lighthouses dispel the darkness of the ocean's breast so that commerce may move, then let ours be the glorious task to master, handle and distribute for the noble use of our fellowman this mysterious element, which is the light of the heavens, and which God has seen fit to place under our control.

On motion of Mr. Britton, the address was referred for review and report to a committee of three, consisting of Messrs. E. C. Jones, S. B. Cushing and T. R. Parker,

[To be Continued.]

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, England, July 10th, 1895.

The Metrical System.—Coal and Sulphate Trades.—Ignorance in High Places.

After reading a certain paper and the discussion thereon that was submitted at the meeting of the Western Gas Association, in America, a few weeks ago, it is interesting to notice that a powerful Parliamentary Committee in England, comprising seventeen members, and having Sir Henry Roscoe as Chairman, have made an exhaustive inquiry into the metrical system of weights and measures, taking evidence on all the points connected with it, and that the result of their deliberations is a powerful and decided pronouncement in its favor. Not only do they recommend that its use should at once be legalized for all purposes, but go so far as to propose that at the end of two years it should be made compulsory. They are very dissatisfied with the existing weights and measures as in general use, considering that they not only handicap our dealings with foreign countries, but that they are an unnecessary hindrance in connection with our home trade. And they recommend that the metrical system should be introduced into all our public schools as a necessary and integral part of arithmetic, and that the youthful students shall be introduced to the decimal system at an earlier period that is the custom at present. All of which shows a remarkable agreement with the views that were advocated before the Western Association.

Such a decided expression of opinion in relation to such a wide subject, carries a refreshing impression of robustness that compares very favorably with the proceedings over the standard of light, but so far as the gas industry is concerned there is not such a pressing need for change as outsiders would suppose. It is true that a tabulated list of all the weights and measures in commercial use shows an impression of confusion and want of reason, but directly we go into actual detail much of this disappears, and we find that, out of an apparent chaos, each particular industry has built up a fairly simple set of weights and measures adopted for its own special use, without reference to the requirements of others. The demands for simplicity and rapidity in completing transactions have led to a kind of "survival of the fittest," and many of the systems in use are as simple (to the users) as it is possible to make them. It may be questioned whether this proposal to put the metrical system into all and every commercial transaction is not something similar to issuing hats or boots of one size only to an army. Take our own industry, for example. Although gas is usually quoted by the 1,000 cubic feet, it is actually sold by the 100 cubic feet, and in practice the 100 cubic feet is the only unit used. I have in some cases done away with the 1,000 cubic feet altogether, and made out the gas bills as by the 100. Thus, instead of putting "10,500 cubic feet at 2s. 11d. per 1,000," which is the usual style, I put "105 hundred cubic feet at 3¼d. per 100." The latter is more easily understood by the consumer, and 3¼d. *sounds cheaper* than 2s. 11d. In general usage gold is not bought or sold by the pound, nor is sugar or tea traded by the dram. So, for each commodity the units that have "survived" are those that are most convenient in ordinary use, and the arbitrary changing of such units appears to be likely to cause much inconvenience. It seems rather arbitrary to be told that we must reject the convenient cental and take our choice between three-tenths or ten-thirds of it instead. The one is too large for a "unit," and the other too small. Most of the materials bought or sold in gas works, such as coal, coke, tar or lime, are traded by the ton and hundredweight, in which case, as in that of gas, the smaller standard is practically the unit. Here, again, there is not much room for further simplification. Any change is something more than a change of terms. That would soon be got over, but it is the change in the intrinsic values of units that will cause the difficulty. With regard to our coinage, the substitution of simple decimal points in place of "12 pence one shilling and 20 shillings one pound," certainly offers some advantage in point of simplicity, especially in regard to exchanges with other coinage. But here again it must be remembered that the 12 and the 20 are not arbitrary quantities only, but have survived on account of general convenience through centuries of regular use. Altogether, while not inclined to oppose the introduction of the metrical system, I do not see that it offers very much advantage either in the way of simplifying the multifarious calculations that fall to the lot of gas works managers, or of facilitating their dealings with their customers.

The present position of the gas coal trade is more favorable to buyers than it has been for some years. There is a brisk competition for orders, and perhaps this is in some measure responsible for the breaking up of the attempt to force the price of gas coal that has prevailed during the last year or two, since the great strikes. Last year I had occasion to observe that the price of gas coal still ran high as compared with house and steam coals; but now there is no difficulty in renewing contracts—which are usually made for twelve months in advance—at reductions of 10 per cent. or so on last year's sales. This is an advantage that is badly needed after events of the last few years, and will afford opportunity for carrying out certain repairs and renewals that have had to stand over during the recent bad times. But there must not be too much hurry in offering reductions of price to the consumers. If it could be proved that anything approaching to permanency had been secured in the coal trade, reduction of price would at once become possible. But this is too much to expect. The real interests of the consumers will be best served, no less than those of the proprietors, by utilizing the present era of cheap coal for improvements and renewals where needed, and for the replenishment of reserve funds that have been heavily cut into of late.

Another reason for observing caution in the administration of affairs is that we must make up our minds to face a heavy loss on sulphate of ammonia during the present season. Prices have run very low for several months now, and there is no sign of improvement. At present gas companies have depended upon the sulphate as a marketable variety of ammoniacal compounds, but if this dull state continues we must consider the advisability of falling back upon others, such as concentrated liquor, carbonate, or chloride, that would command a more advantageous price. For some reason or other the quantity of sulphate used in this country for agricultural purposes is far less than its intrinsic value would lead one to expect. Other substances, some exported from foreign parts, appear to be preferred, although not so valuable in a chemical sense. All attempts to encourage a local demand for sulphate are more or less failures, and, with the exception of one or two who enjoy special advantages, there are no gas undertakings who can dispose of any important proportion of their total make in their own neighborhood. At present the only property of ammonia that is considered is the manurial capability, but perhaps some enterprising manufacturer will seek to turn its alkaline properties as a detergent and cleanser to practical account.

A surprising amount of ignorance on the subject of gas supply and consumption was exhibited by a London magistrate a few weeks ago in the course of his professional work. He was hearing a case against a consumer, who was one of that class who believe in making laws for themselves rather than obeying existing ones, and as a result of following that policy was called upon by the gas companies to account for an infringement of their by-laws. I once saw a magistrate, after leaving the court, engaged in an altercation with a workingman. The workman told the dignitary that when in court and occupying the judicial chair there was some difference in their respective positions, "But out here we are equals," he added. Similarly the fact that the statement in question, although ignorant and unwarrantable to a degree that would prevent its attracting any notice at all if uttered by a private individual, emanated from the presiding officer of a court of law, invests it with an amount of weight and authority that otherwise it would not claim. The daily press, ever willing to tickle the public fancy by a kick at the gas company, have made the most they can of it. The worthy magistrate was good enough to credit the gas officials with courteous behavior. His complaint against them was that they had not explained to his satisfaction why the charge for gas varied from quarter to quarter with the same number of lights in use and the same habits in the household. And to this he added a surmise that the company were able to force the meter by increasing the pressure. It is easy to read between the lines. January, February and March of this year were unusually cold months. The corresponding period for 1894 was remarkably mild. The bills for these three months were lower than usual. But in 1895, for reasons which will be plain to every gas engineer, they were higher. The magistrate could not appreciate the fact that with one or two gas heating appliances in almost every house, and remembering the common custom of turning up the lighting burners to take the chill off the air in severe weather, it is only reasonable to expect that the quantity of gas used will in some sense be a function of the temperature. It is strange that intelligent, well-educated men should be so ignorant, but I have heard of similar cases, such as a wine merchant who used gas stoves to keep his cellars at a regular temperature, and yet expected that his bill for 1895 should practically be the same as that for 1894. But the point of the matter is, that after all our exhibitions, our lectures on gas burners, circulation of pamphlets, etc., there are still many ignorant notions about gas, prevalent even in what are usually supposed to be well-informed circles. And that further efforts in the direction of educating the consumer are yet necessary.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following chapter, which looks to be the beginning of the end in the gas war at Terre Haute, Ind., is a notice of sale by the assignee, Mr. Buena V. Marshall, of the belongings of the Citizens Gas and Fuel Company: "Notice is hereby given that the undersigned assignee will offer at public auction, beginning on Tuesday, at 10 o'clock, A.M., August 13th, 1895, all the property of the Citizens Gas and Fuel Company, of the city of Terre Haute, Ind., that is known as the plant, consisting of outlot, No. 19, with the buildings, gasholder and oil tanks thereon, including the machinery and other apparatus in said buildings, together with the gas mains or pipes laid in the streets and alleys of said city and the pipes connecting same with the dwelling houses and other buildings, will be offered for sale as constituting said plant. Such personal property as is located on outlot 19 and the plant will be offered for sale from the office of the Company, on North Second street, between Eagle and Chestnut streets. The remainder of the personal property will be offered for sale from the main office of the Company, No. 30 South Sixth street. The plant will be offered first, then the personal property located on outlot 19, and then the personal property at the main office, No. 30 South Sixth street. The sale will continue from day to day, until all the property is sold. Terms cash."

AT the annual meeting of the Easthampton (Mass.) Gas Company a dividend of 3 per cent. for the past six months was declared. The officers chosen were: Directors, E. T. Sawyer, John Mayher and H. L. Clark—the latter replaces Mr. G. H. Leonard; President, E. T. Sawyer; Clerk, H. L. Clark; Treasurer, G. L. Manchester.

THE Standard Gas Light Company, of this city, has just placed an order with the United Gas Improvement Company, of Philadelphia, for generating apparatus of its well known standard "double superheater" form of water gas plant, of a capacity aggregating 4,000,000 cubic feet per diem. The Standard Company heretofore has operated with apparatus of the Flannery type, but the recent change of conditions in the oil market, involving a probable difficulty in the securing of a satisfactory naphtha supply hereafter, has impelled it to install a plant that will successfully handle the cheaper available crude and gas oils, with the result as above. The new machinery will go in at the Company's 115th street station, in place of a number of the Flannery machines that will be removed, and despite the magnitude of the work, it is agreed that at least a portion of the apparatus shall be ready to make gas by October 1st—a date less than 90 days from the receipt of the order, and which, at this busy season especially, speaks well for the facilities of the United Gas Improvement Company for quick construction.

ANOTHER recent order that is now being put through the shops of the United Gas Improvement Company is one from the Calumet Gas Company, of South Chicago, Ills., for water gas apparatus of a half million daily capacity, the same to be on the lines of the regular standard equipment of Lowe type, as constructed by the first named Company. The satisfaction in this contract, apart from the profit that may come from it, to the United Gas Improvement Company, comes in from the fact that this is a second order from the Calumet Company, after experience by that Company with apparatus erected for it under a former contract; wherefore it is fair to assume that the satisfaction to the Calumet Company comes in from the fact that the growth of its business has been so great that it is obliged to not only install the new apparatus in question, but at the same time to make it of double the capacity of the first installation, upon which pronouncedly happy commercial conditions we heartily congratulate it.

MR. WILLIAM R. CURRY has resigned the position of Superintendent of the Albion (N. Y.) Gas Light Company.

THE 6-inch wrought iron pipe under the Hackensack river, connecting up the works of the Hackensack (N. J.) Gas Company with the borough of Bogota, on the east bank of the river, has been laid. Gas was turned on to some of the public lamps in Bogota on the evening of Thursday, July 18th. The pipe was laid by Mr. Walter P. Elliott.

A COMPANY has been organized to supply the town of Appalachicola, Florida, with gas. This place, which is a port of entry and the capital seat of Franklin county, is on the Gulf of Mexico, at the mouth of the Appalachicola river. Cotton shipments are frequently made from this point, and it also has many establishments for the manufacture of lumber. Population about 3,500.

THE Celina (Ohio) Gas Company has been incorporated with a capital of $50,000. This place is the capital of Mercer county, Ohio, and is on the Wabash river, at a point 66 miles, by rail, northwest of Dayton. It can be reached by the line of the Sandusky division of the Erie Railroad. Population, 3,200.

THE Syracuse (N. Y.) *Post*, of the 19th inst., says: "The owners of the illuminating gas franchise, Messrs. Hiscock, Dunfee, Kirk and others, met yesterday afternoon, with the intention of sealing the negotiations with the New York and Philadelphia capitalists for building a plant in this city, but a disagreement prevented an acceptance of the proposition of the out-of-town people. The hitch in closing up the transaction lies in the contest for the controlling representation in the Board of Directors. Both parties have so far agreed that each shall be represented by four Directors, but the selection of the ninth Director has not yet been made. The local people at their meeting yesterday failed to agree upon any one of the plans for disposing of the question of this ninth member. George Wm. Ballon, the New York banker, who represents Senator Calvin S. Brice, of Ohio, had a conference with the local grantees yesterday, for the purpose of closing up a contract with them for prospecting and bringing natural gas to this city."

A CORRESPONDENT at Scranton, Pa., under date of the 19th inst., forwards the following obituary note respecting the Hon. Jas. L. McMillan, for many years Treasurer of the Pittston (Pa.) Gas Light Company: "With regret I inform you of the death of the Hon. Jas. L. McMillan, a prominent resident of West Pittston, Pa., who passed away on the 13th inst. He succumbed to heart trouble, from which he had been a sufferer for years. Deceased was born in Wanlockhead, county Dumfries, Scotland, some time in 1830, and came to this country in his youth, settling in West Pittston, where he has since resided. From 1857 to 1888 he, with Andrew H. Law, successfully conducted a large general store. He served as a Councilman from both Pittston and West Pittston, and in 1883 represented the old Seventh Luzerne district in the Legislature. He was Burgess of Pittston, Treasurer of the Pittston Gas Light Company, Treasurer of the Grand Lodge of the Knights of Honor since the organization of that body, Vice-President of the Miners' Savings Bank, President of the New York and Pittston Coal Company, Director of the Water Street Bridge Company, and a prominent member of the Presbyterian Church. Many years ago he married Miss Hannah Howarth, who died in 1887. He is survived by three children—Mary H., Wm. H., and Sarah."

THE proprietors of the Erie (Pa.) Gas Company have purchased the plot at the southeast corner of Seventh and Peach streets, and will in due time erect a handsome office structure thereon. A bit of comedy in this action lies in the fact that Mayor Scott strongly urged the purchase of the plot on account of the city, for the purpose of building there a permanent structure to be used as a fire department headquarters. The Council, or some of the members thereof, thought the price named was too high, and others of them hinted that the Mayor's lively advocacy of the bargain was not altogether disinterested. That these insinuations were of the bombastic and unpardonable sort can best be proved by the fact that the Gas Company paid the equal price for which the plot was offered to the city.

AT the annual meeting of the Stillwater (Minn.) Gas and Electric Light Company the officers chosen were: Directors, Isaac Staples, E. L. Hospes, David Toyer, A. T. Jenks, E. W. Durant, David Bronson and N. N. Johnson; President, Isaac Staples; Vice-President, E. L. Hospes; Secretary and Treasurer, R. S. Davis; Superintendent, N. N. Johnson.

ADAMS, Mass., is to have a water gas plant, the Gas Company at that point having contracted with the United Gas Improvement Company for one of its sets of "Junior" water gas apparatus, especially designed for gas works of small calibre. The new system will not replace the existing coal gas plant, but will be located alongside thereof, the proprietors of the Company concluding that they desire to be equipped with both systems so as to be in a position to make whichever gas may at any time be made the cheaper and at all times have the advantages of each. A new gasholder, in steel tank, is included in the work underway, together with the remodelling of the works, connections, etc., so that it is safe to say that the equipment of the Adams Company will soon be in as good shape as one could wish it.

A LOUISVILLE correspondent forwards the following: "The plant and franchises of the Shelbyville (Ky.) Gas Light Company became the property of a syndicate of local capitalists about a fortnight ago. The

members of the syndicate are Messrs. L. Chowning, G.W. Lo,an, Jno. I. Logan, L. C. Willis, Jas. Stewart, T. C. Bailey, Thos. Wallace, H. P. Poynter and L. G. Smith. The sale was made by Mr. T. L. Fitch, the representative of the Louisville parties who owned the property. Possession will be given August 1st, until which date the works will remain under the old management. The new Company has not yet been organized and no definite plans have as yet been perfected, but the policy of the owners will be to furnish a first-class service. The fact that many of the members of the new syndicate are largely interested in the Shelbyville water and electric light supply indicates that the two concerns will work on friendly terms, although each will continue to be an independent corporation. The Shelbyville gas works were built 22 years ago by Mr. John B. Geary, of Lexington. The capital stock of the corporation was $20,000, one-half of which was subscribed by the citizens of the town, and the other half was owned by Mr. Geary, who managed the works for a number of years. Consumers, when the works were first built, were charged $5 per 1,000 cubic feet, which price was afterwards reduced to $4, and then to $2.50. The latter rate ruled until May 1st, 1895, when the rate was cut to $1 per 1,000."

THE Municipal Gas Company, of Albany, N.Y., has declared a quarterly dividend of 2 per cent., payable August 1st. The transfer books are to be reopened on August 2d.

"A. F. R.," writing to us from Mankato, Minn., under date of the 18th inst., says:

Dear JOURNAL: The following preamble and resolutions, which were introduced in the Mankato (Minn.) Council some time ago, and which were defeated by the narrow margin of a single vote, are forwarded you as an evidence of the trend of the lighting policy of the authorities:

"*Whereas*, In the judgment of many of the citizens of Mankato it would be to the interest of our growing city to have an electric railway; and,

"*Whereas*, If the city of Mankato erects and operates its own lighting plant it can only do so to the extent of street lighting, being prohibited by law from doing commercial lighting; and,

"*Whereas*, The item of commercial lighting is of vital interest to the citizens and taxpayers of our city; and,

"*Whereas*, If the street lighting is taken from the Gas and Electric Light Company now doing business in the city of Mankato, leaving said Company commercial lighting only, we cannot even hope for a reduction from present prices; and,

"*Whereas*, We have been informed by those in a position to know, that one Company could greatly cheapen both street and commercial lighting by combining in one plant street and commercial lighting and the operating of an electric railway; therefore, be it

"*Resolved*, By the Common Council of the city of Mankato, that the Committee on Street Lighting be requested to advertise for bids for doing city and commercial lighting, providing such Company or Companies bidding shall agree to combine with said city and commercial lighting the construction and operation of an electric street railway, upon such conditions as the Council of the city of Mankato shall hereafter stipulate; and be it further

"*Resolved*, That the said Committee on Lighting shall at the same time advertise for bids for the erection of an electric lighting plant of 100 arc light power, in the city of Mankato."

ACCORDING to the report of the committee appointed by the City Council, of Athens, Ga., to investigate and report upon the cost of establishing an electric lighting plant, to be operated on public account, and to be up to the maintenance of 100 arcs of 2,000-candle power each, such plant would cost, complete, $15,000. It was also figured out that the lamps could be maintained at a cost of $41.63 per arc per annum, which estimate made no allowance for interest charges, renewals, depreciation, etc.

MR. A. F. KELLY has been appointed Superintendent of the Hamilton (O.) municipal gas and electric light plant.

THE Capital Gas Company, of Sacramento, Cal., will install a water gas plant; and we also understand that the Company is about to make quite a concession in the gas rate.

ATTENTION is called to the advertisement of Mr. W. S. Wharton, Superintendent of the Bellingham Bay Gas Company, of Fairhaven, Wash., who is desirous of securing 100 good second-hand street lanterns, suitable for carrying the Welsbach lamps for purposes of street illumination.

THE proprietors of the Lockport (N.Y.) Gas and Electric Light Company are to furnish the Lock City Electric Street Railway Company with power to operate the generators of the latter. To carry out the contract the Company has determined to install a 150-horse Armington & Sims engine.

THE Cambridge (Mass.) Gas Light Company has declared a semi-annual dividend of 5 per cent., payable August 1st.

THE Bridgewater Natural Gas Company has notified the residents of East Liverpool, O., that an increase of 25 per cent. in the selling rate will go into effect on October 1st.

THE Malden and Melrose (Mass.) Gas Company has declared a quarterly dividend of 3 per cent., payable August 1st.

THE regular semi-annual dividend of 5 per cent. on the shares of the East Boston Gas Company is payable on demand.

THE Newark *News*, of the 22d inst., had this to say: "Every detail has now been perfected for the official amalgamation and reorganization of the Newark and Citizens Gas Light Companies. The delay was caused by the legal transfer of a block of 56 shares in the Citizens Company, which were originally held by a woman who died intestate. Administration papers had to be taken out in the French courts, so that the heiress could be legally qualified to vote for the reorganization and sign acceptance of the cash, stock and bonds of the new concern, which is to be known as the Citizens Gas Company, both titles of the existing Companies to be absorbed. The papers for the transfer of the Newark Gas Light Company stock have been ready since April 23d. The bond certificates are being engraved, and it will take about a month to have them made out. Under the adjustment the stockholders in the Newark Gas Light Company will get $250 a share in 6 per cent. bonds and 50 per cent. in cash out of the Company's treasury surplus. This will make about $300 per share. The holders in the Citizens Gas Light Company will get $150 per share in 6 per cent. bonds, $100 in stock, and a share of the treasury surplus. Mr. Eugene Vanderpool, President of Newark Gas Light Company, said some months ago that he would not under any circumstances accept the Presidency of the new concern. In fact, he has been determined for some time to retire. It is pretty well settled among the largest stockholders that Henry C. Kelsey will be the President. He was selected from the start, but afterwards some of his supporters were weak kneed. It is now stated that he has won them over."

THE following resolutions were adopted at a meeting of the Richmond (Va.) Council, held on the 19th inst.:

"Be it resolved by the Council of the city of Richmond, the Board of Aldermen concurring:

"*First*. That an examination by a competent accountant from time to time during each year be made into the accounts and condition of the gas department, and with every other department of the city government. It is idle to expect the committees of the city government to examine the books of their respective departments. It is a responsibility and a labor which should not be put upon them. It must be done by some one independent of the departments, and whose special duty it shall be to do such work.

"*Second*. That the position now held by Mr. J. F. Meredith, as clerk and bookkeeper at the gas works, be declared vacant, and that the Committee on Light, instead of the Superintendent, be authorized to fill the vacancy, and he be bonded in the sum of $2,000.

"*Third*. That the City Attorney be instructed to take all proper steps to recover the moneys justly due the city by reason of the defalcations of the late W. C. Adams, Superintendent of the city gas works, either from the estate of W. C. Adams, or from the surety on his different bonds as Superintendent, and bring suit if necessary."

ACCORDING to the *Electrical Review* a successful experiment was recently made in Louisville, Ky., to demonstrate the feasibility of taking telegraphic dispatches directly from the wire to a type setting machine; a giant sounder in a resonator was placed near the operator's ear and the messages were set in type on a linotype machine; a maximum speed of 50 words a minute was attained and kept up; the speed of the fastest telegraphers is seldom more than 50 words per minute, while that of the fastest linotype operators is often 7,500 ems; for an average speed of 25 words per minute the average for the linotype is 4,500 ems per hour, showing that the relative speeds are about the same; for associated dispatches this does away with the intermediate services of the typewriter. It is believed that the practicability of the system has been fully demonstrated, but its adaptability is yet to be proved.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

MONDAY, JULY 29, 1895.

Indian Territory Oil.

The Chicago *Herald* is authority for the statement that a company is being organized in Chicago to work the oil fields of the Indian Territory. The great mineral resources of that region have been known for some time, but on account of the difficulty of access and the inability of white men to obtain grants from the Indian governments nothing has been done toward their development. In Kansas and Arkansas, directly on the border of the Indian lands, rich coal mines have been opened and many oil wells sunk.

Last winter a number of Chicago capitalists sent a prospector through the Cherokee and Muskogee nations. He spent several months traveling through the country, and on his return reported that there was a vast quantity of oil and coal in the Okmulgee, Muskogee, Eufaula and Deep Fork districts of the Muskogee, commonly called the Creek nation. The prospector was then deputed a lobbyist, and after laboring through a session of the Congress of the Creek Nation, he succeeded in obtaining a grant of over 1,500,000 acres of land. The Muskogee Oil and Gas Company was incorporated with a capital stock of $1,000,000, most of which has been subscribed in Chicago. The promoters of the Company expect to begin operations within a few months.

Oil and gas were first struck in the Indian Territory many years ago in boring for salt. It was not required to bore to any great depth, as is the case in the fields of Pennsylvania and Ohio, and it is said that oil and gas can be more cheaply obtained in the Territory than in any other section of the country. The Creek Nation retains the proprietorship of all mineral lands within its borders, demanding a royalty from all the companies which are given grants. The royalty on coal is fixed by law at 5 cents a ton, on rock and stone at 3 cents a ton, on oil 4 cents a barrel of 50 gallons, on natural gas $25 a year for each well well from which gas is sold, and on all the other minerals 5 per cent. of the value of such minerals at the place of production.

An assay of lubricating oil found in the Creek Nation compares favorably with that found in India, which is considered the best in the world, and contains a larger per cent. of lubricating fluid than any other oil of its kind found in America.

Emil Riese, who obtained the grant from the Creek National Council, and who has lived in the Nation for several months, said that traces of oil and coal had been discovered in almost every part of the Creek lands. At one place natural gas is constantly escaping in large quantities, and the oldest inhabitants relate that this gas was once used as a beacon light on the prairie.

"It has been long known," Mr. Riese said, "that coal, oil and gas exist in great quantity in the Indian Territory, and many efforts have been made to obtain grants and work the fields, but until recently the richness of the fields was not known outside of a few acquainted with the country and who appreciated the value. Gas and oil have been found only 200 feet from the surface. In boring for salt, oil has been found which spoiled the salt, and the wells were abandoned. In the Muskogee the facilities for transportation are probably better than in any of the five Indian nations. Three railroads run through the land, and the Canadian river provides a waterway to the Mississippi. The difficulties of carrying the oil and coal from the region have been overestimated. Should oil be found in great quantities it would be an easy matter to extend three or four great railway systems into the Territory. Up to date only the crudest machinery has been used in working the fields and the meager results that have been obtained are not surprising.

"Some think that the oil fields of the Cherokee and Muskogee nations are the richest in the country. The cheapness of obtaining the oil is an incentive to experiment. At the deepest one would have to drill only about 800 feet, while in Pennsylvania it is required to go down from 1,800 to 2,400 feet."

The Market for Gas Securities.

The market for city gas shares showed no animation last week, although Consolidated held fairly well. The opening to-day (Friday) was made at 140 to 140¼, but the transactions in it are nothing more than nominal. Other city shares are dull, although Standard preferred is inquired after with some frequency, and 107 is freely bid for it. Holders demand 108¼. New York and East River common is quite closely held, and well informed people regard it as a purchase at 32 or under. One certain thing in connection with the Company is that there is plenty of water in its tunnel. The Brooklyn situation is as before, but important developments may be looked for there now at any moment. Chicago gas is again in the see-saw stage. It sold up about 5 points during the week from our last quotation, and opened to-day at 53¾ to 54. As we said a week ago, no one can go wrong through buying Chicago at the market figure. Bay States were even during the week, but Lacledes are weak and lower. Consolidated, of Baltimore, shows no change. Western, of Milwaukee, is bid for at 65, with all signs pointing to a still higher range.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

July 29.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	140	140¼
Central	500,000	50	140	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	194	197
Bonds, 6's	1,000,000	1,000	106	..
" 1st Con. 5's	2,300,000	1,000	106	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	170	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
Northern	150,000	50	90	91
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	30	32
Preferred	2,000,000	100	55	57
Bonds	3,500,000	1,000	94¾	95¾
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	65	67
Preferred	5,000,000	100	107	108½
Bonds, 1st Mortgage, 5's	1,500,000	1,000	106	..
Yonkers	299,650	50	101x	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	820,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	108	..
Peoples	1,000,000	10	90	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	225	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	210	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	50	19	20¼
" Income Bonds	2,000,000	1,000	33	..
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	..	79½
2d " " "	3,000,000	1,000	..	53
Buffalo Mutual	750,000	100	120	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	100	53¾	54
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds	7,650,000	1,000	93	93½
Columbus	1,000,000	..	63	66
1st Mortgage	1,085,000	..	91	93
Consumers. Jersey City	2,000,000	100	89	..
" Bonds	600,000	1,000	101	..
Cincinnati G. & C. Co.	7,000,000	100	203½	..
Consumers, Toronto	1,600,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	63¾	63¾
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	29	..
" Con. Bonds	4,312,000	..	72	73½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	74	75
" Bonds	2,000,000	..	84	86
Hartford	750,000	25	120	128
Indianapolis	2,000,000	..	153x	..
" Bonds, 6's	2,650,000	..	106	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	86
Bonds	1,000,000	1,000	86	88
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	23¼	23½
Preferred	2,500,000	100	83	88
Bonds	9,084,400	1,000	96	96½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
New Haven	.....	25	225	..
Northwestern Ohio Nat. Gas	.....	..	48	..
Oakland, Cal.	.....	..	43¾	45
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	72¾	73¾
St. Paul Gas Light Co.	1,500,000	100	68	70
1st Mortgage, 6's	650,000	..	..	..
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	65	67
Bonds, 5's	3,556,000	..	94½	96½
Wilmington, Del.	500,000	50	188	190

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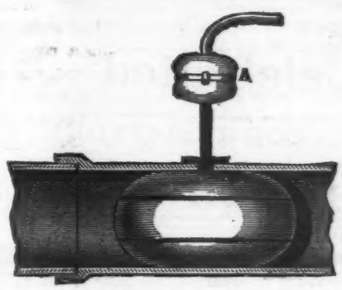

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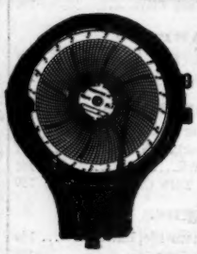

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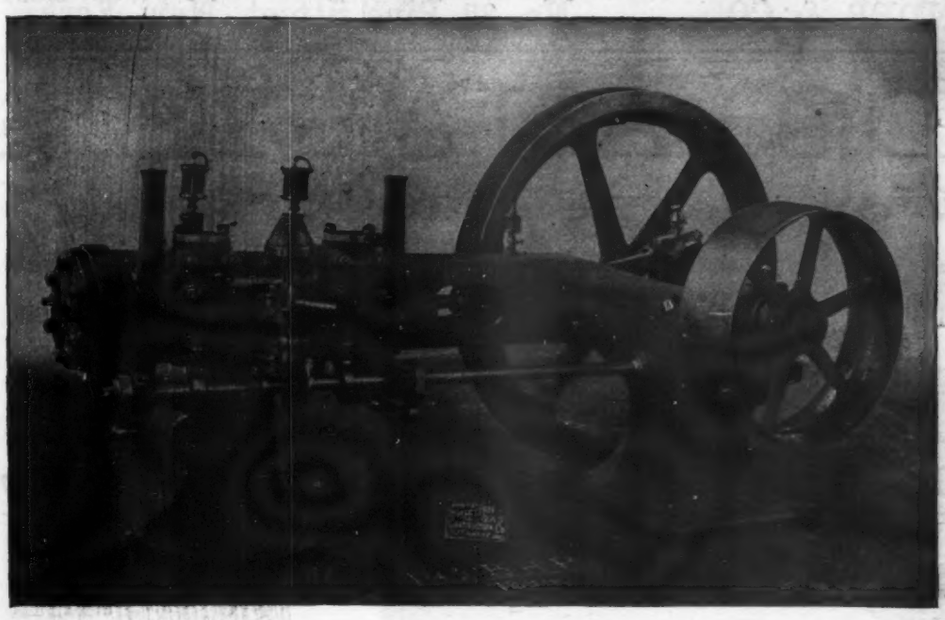

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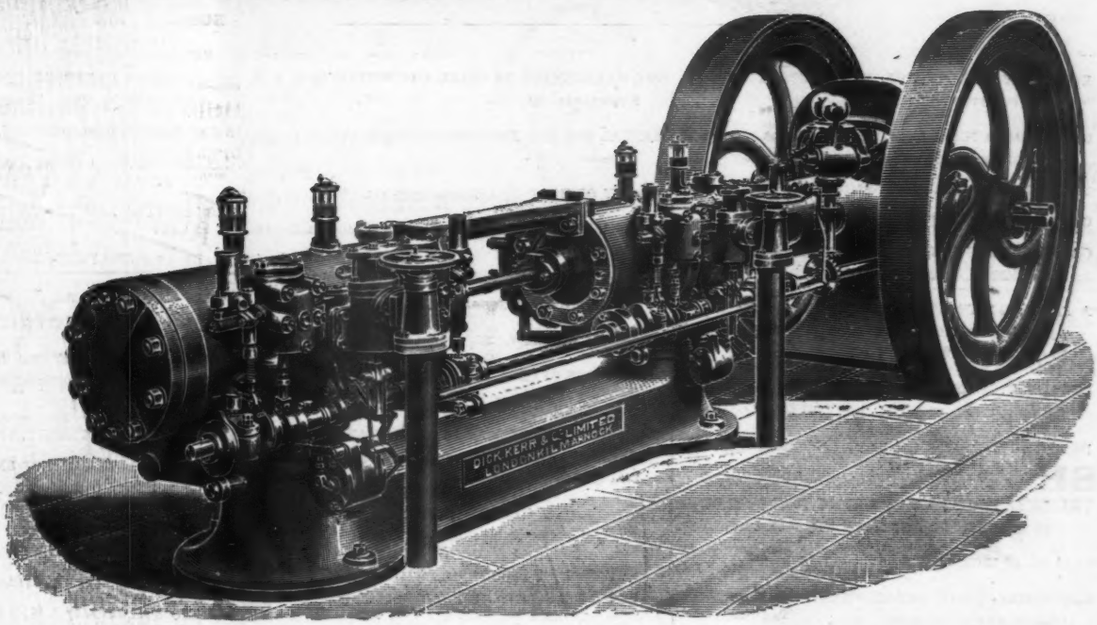

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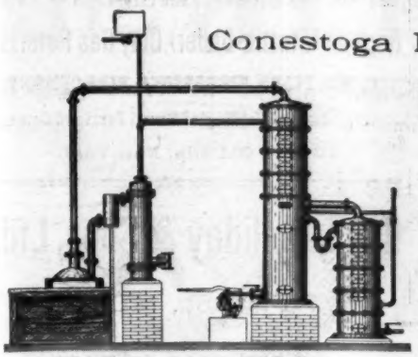

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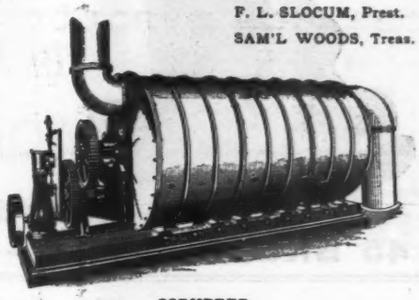

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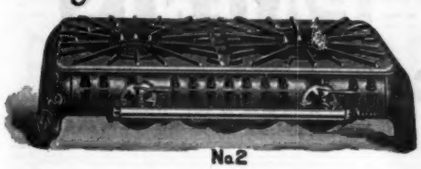

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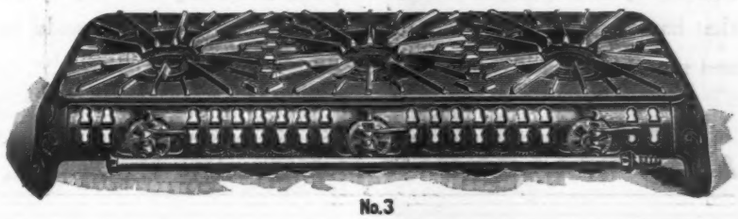

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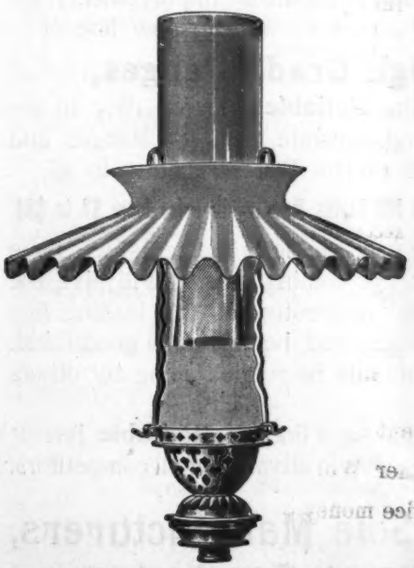

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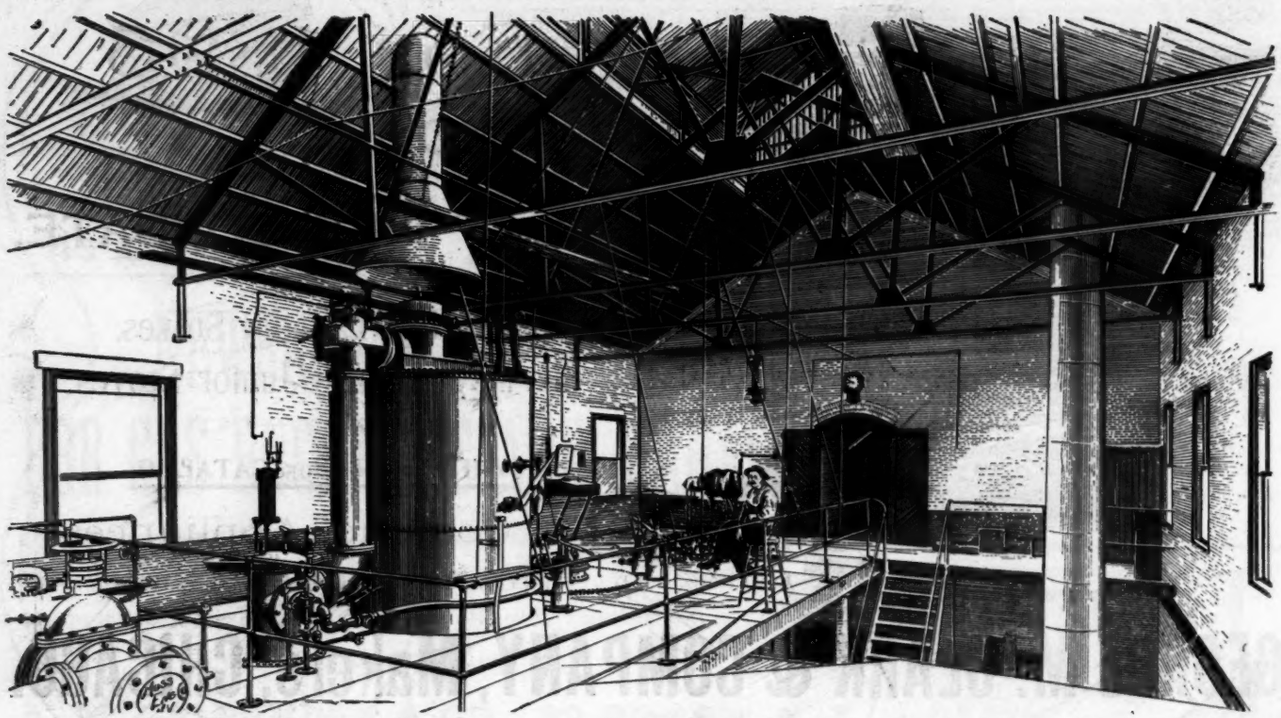

The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

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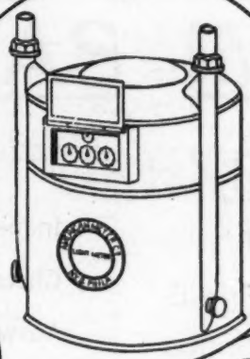

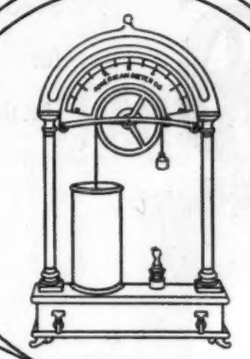

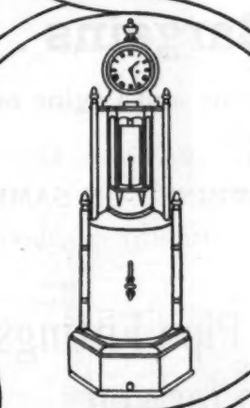

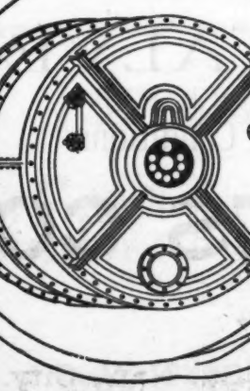

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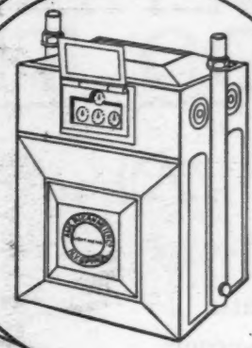

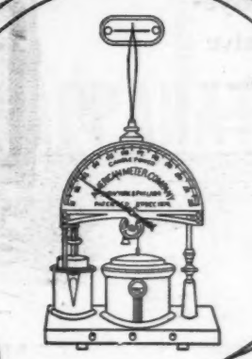

PUBLIC LIGHTING TABLE.

AUGUST, 1895.

Day of Week.	Table No. 1. FOLLOWING THE MOON.			Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M.	A.M.
Thu.	1	12.40 AM	4.00 AM	7.10	3.30
Fri.	2	1.40	4.00	7.10	3.30
Sat.	3	2.40	4.00	7.10	3.30
Sun.	4	No L.	No L.	7.10	3.30
Mon.	5	No L. FM	No L.	7.10	3.30
Tue.	6	No L.	No L.	7.10	3.45
Wed.	7	7.40 PM	9.10 PM	7.10	3.45
Thu.	8	7.40	9.30	7.10	3.45
Fri.	9	7.40	9.50	7.10	3.45
Sat.	10	7.40	10.10	7.10	3.45
Sun.	11	7.30	10.30	7.10	3.45
Mon.	12	7.30	11.00	7.10	3.45
Tue.	13	7.30 LQ	11.30	6.55	4.00
Wed.	14	7.30	12.10 AM	6.55	4.00
Thu.	15	7.30	1.00	6.55	4.00
Fri.	16	7.30	2.10	6.55	4.00
Sat.	17	7.30	4.20	6.55	4.00
Sun.	18	7.20	4.20	6.55	4.00
Mon.	19	7.20	4.20	6.55	4.00
Tue.	20	7.20 NM	4.20	6.45	4.10
Wed.	21	7.20	4.20	6.45	4.10
Thu.	22	7.20	4.20	6.45	4.10
Fri.	23	7.20	4.20	6.45	4.10
Sat.	24	7.20	4.20	6.45	4.10
Sun.	25	8.20	4.20	6.45	4.10
Mon.	26	9.00 FQ	4.20	6.45	4.10
Tue.	27	9.50	4.20	6.30	4.20
Wed.	28	10.40	4.20	6.30	4.20
Thu.	29	11.30	4.20	6.30	4.20
Fri.	30	12.40 AM	4.20	6.30	4.20
Sat.	31	1.40	4.20	6.30	4.20

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

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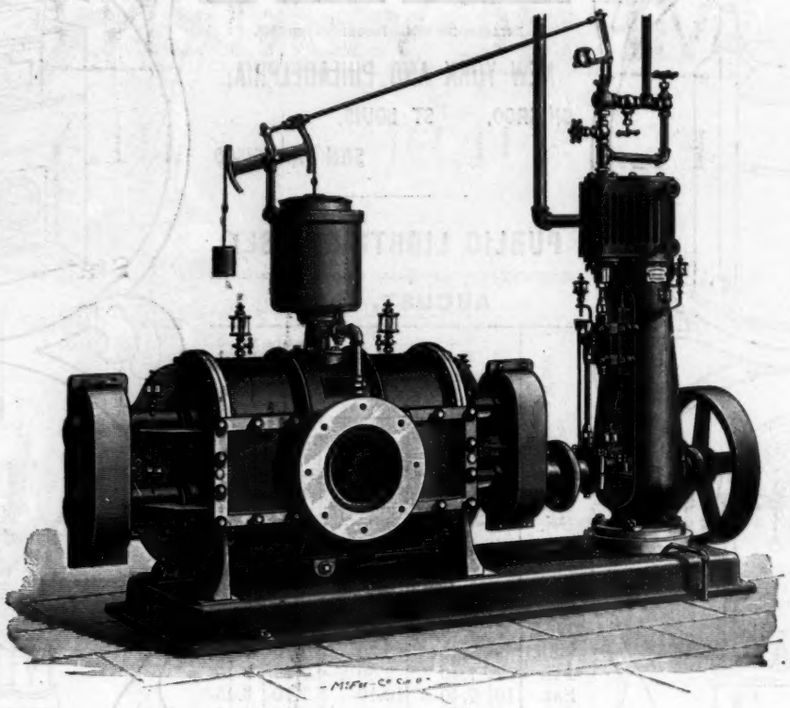
Our Latest Improved **Automatic Gas Governor** and **Steam Bye-Pass Valve** are the best in the market.



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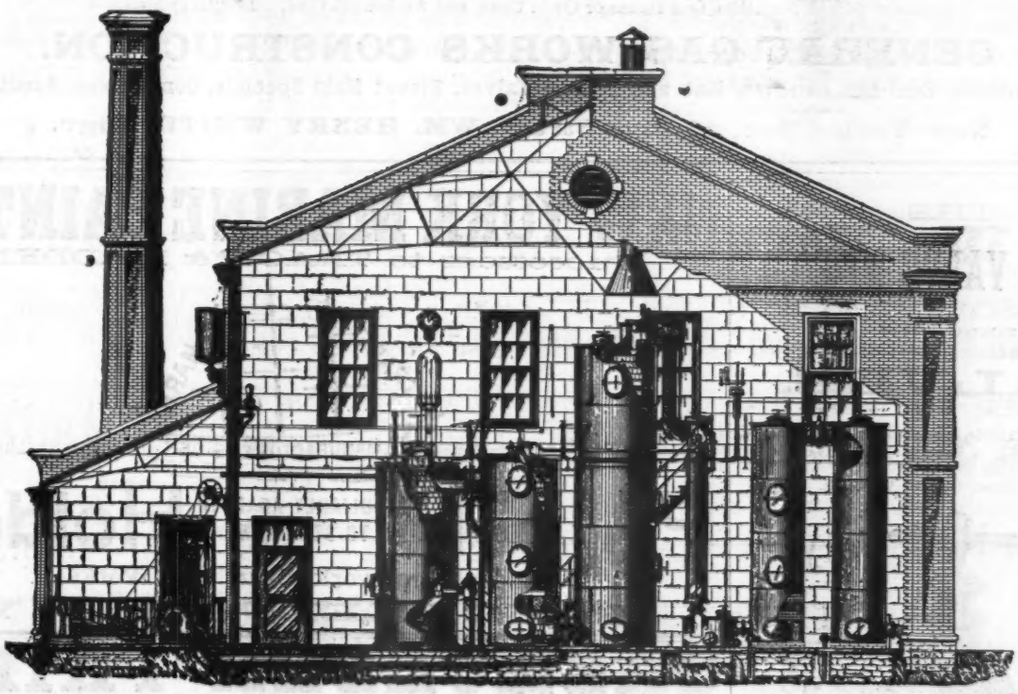

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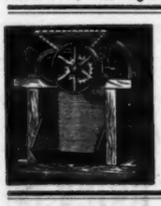

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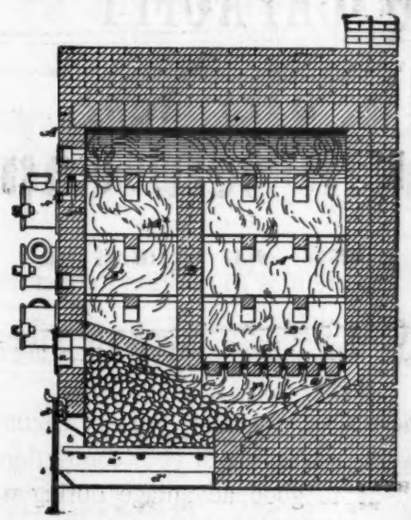

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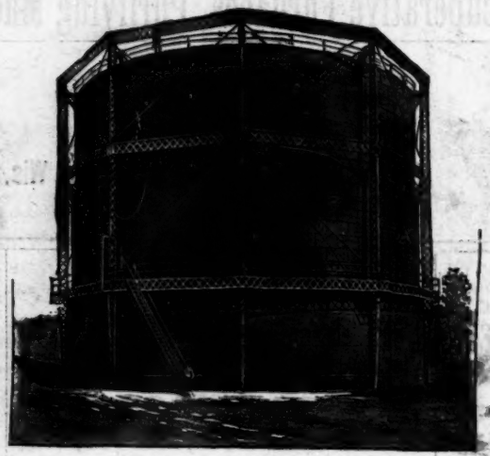

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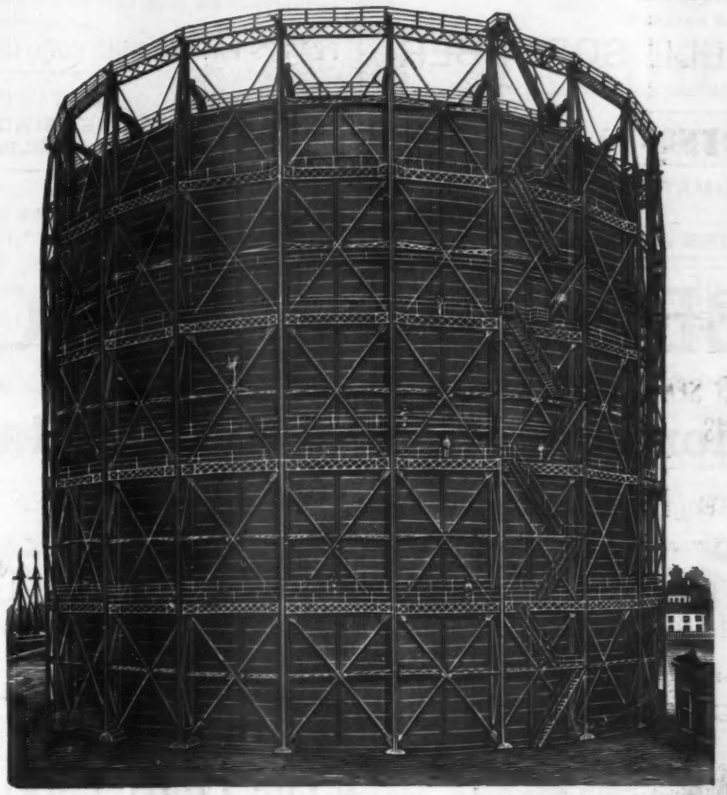

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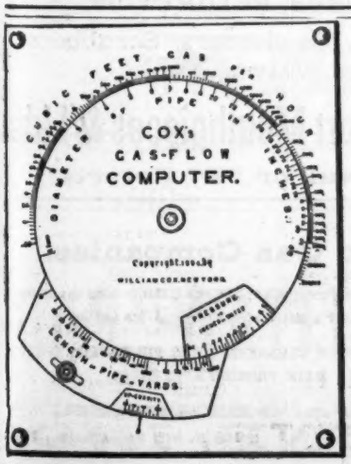

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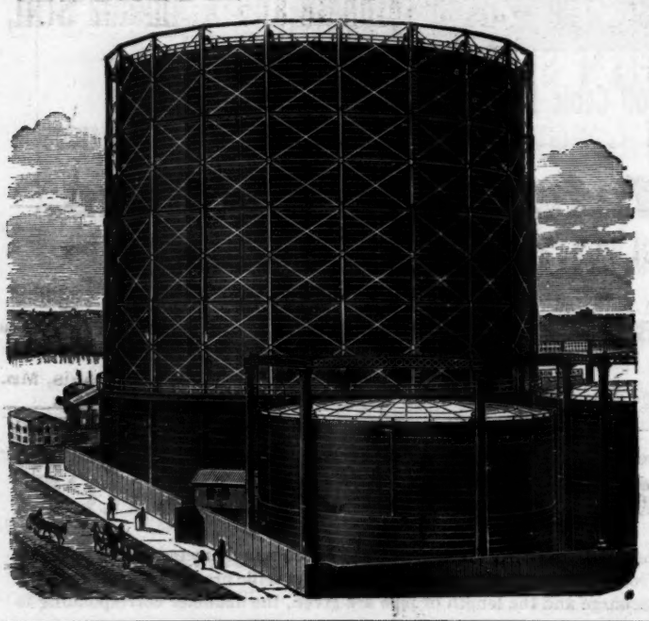

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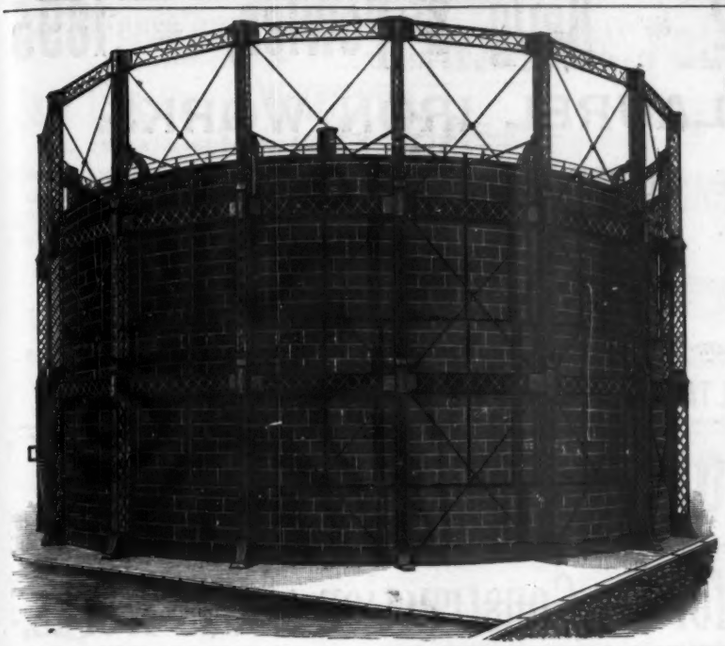

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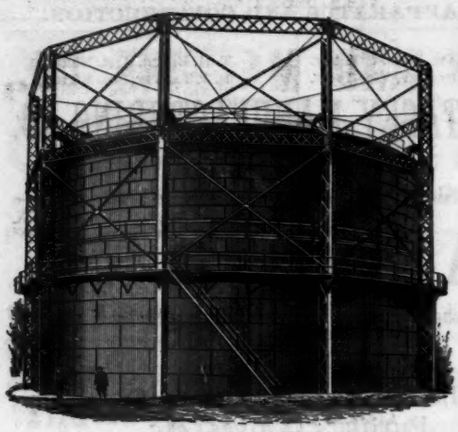

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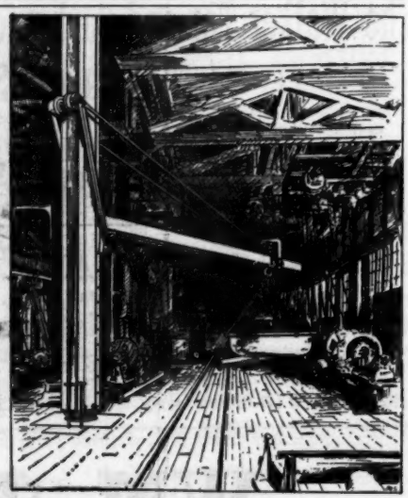

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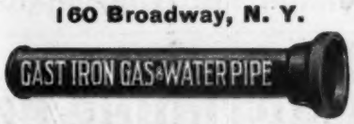

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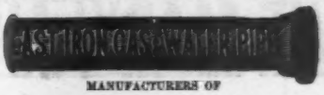

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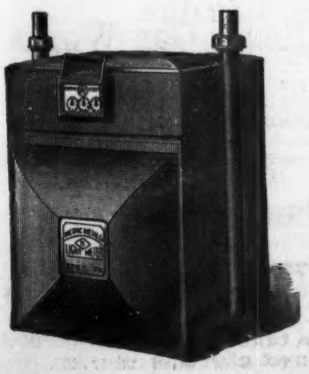

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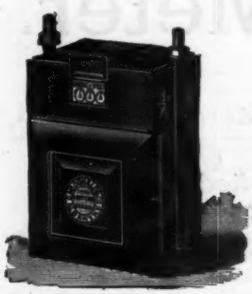

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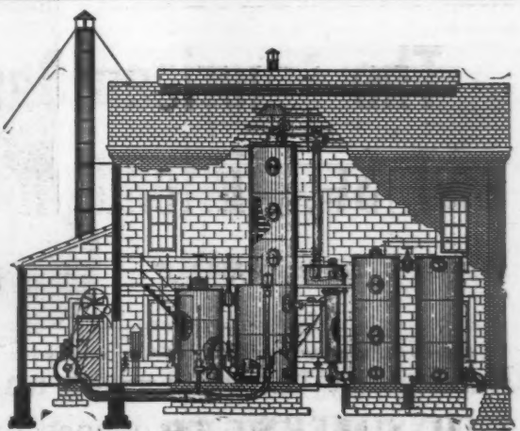

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